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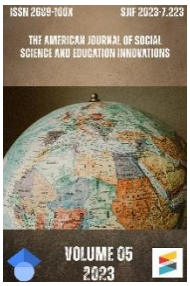

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Research Article

AVICENNA ON ILLICIT CROSSING THE BOUNDARIES BETWEEN THE SCIENCES

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ABSTRACT

Islamic commentators of Aristotle's Posterior Analytics, particularly Avicenna and Averroes point to unify the last sentence of I.6 and the first of I.7, and thereby shed a new light of Aristotle's kind-crossing prohibition rule. Moreover, this paper will argue that despite Aristotle tried to strictly demarcate the boundaries of the sciences; in fact, he himself could not achieve it in the explanation of the healing of circular wounds. This case made Avicenna to widen the boundaries of the canons of demonstration.

KEYWORDS

Kind-crossing prohibition, per se attributes, middle term, demonstration transfer, scientific syllogism.

INTRODUCTION

Aristotle set restrictions on moving from one science to another on the grounds of the illicit kind-crossing prohibition. He objected to it on the basis of ambiguity which led to erroneous arguments. Despite much of the literature is dedicated to this specific topic it is surprising not to find any separate study concerning Islamic philosophers' commentaries on this issue.

Avicenna was the first philosopher among the Commentators of Aristotle's Posterior Analytics, who devoted a separate chapter i.e. Burhān II.8 on the problem of kind-crossing. Moreover, this problem is also studied in other chapters of the Burhān and his other works. In this paper, we provide Avicenna's account of illicit crossings between the sciences. First, we examine technical part of it and establish that Avicenna understands kind-crossing prohibition as a consequence of per se belonging. After, to strengthen our argument, we outline Aristotle's notions of demonstrative syllogism. It will be argued that even for Aristotle, per se belonging was the main rule of kind-crossing prohibition. Next, we will turn to Avicenna's general account of illicit crossing. Throughout of the

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corpus, The Healing, he maintains to strict observance of the appropriate scientific method. In section 6, we see his groundbreaking contribution to the division of the sciences by excluding the Categories from logical texts. In section 7, we provide Avicenna's commentary on Aristotle's confused example of the healing of circular wounds. Here, we maintain that this example forces Avicenna to make some curious and perhaps contradictory claims about the subordination of the sciences. In the last section 8, we will turn to Avicenna's Remarks and Admonitions, where he, we think, widens the boundaries of the sciences.

2. Unifying the Gap between APo. I.6 and I.7

In the beginning of the Posterior Analytics I.7 we see the introduction of the concept of kind-crossing:

Hence, it is not possible to prove a fact by crossing from one genus to another – e.g., something geometrical by arithmetic [1: 12]

Modern authors are divided into two groups concerning the interpretation of this statement. First group [1; 7: 226; 8: 182] merely quotes only this sentence when they want to deal with the rule of prohibition, i.e. they accept it as an opening of I.7. The second group [11: 57; 13: 4; 1: 130] considers the first sentence of I.7 as the last sentence i.e. consequence of the argument expressed in I.6. Nevertheless, as Philipp Steinkrüger [14: 40-43] indicates this cut between two chapters was not properly studied in depth, and proceeding from 16th-century Italian philosopher Jacopo Zabarella's commentary on the Posterior Analytics, he argues that it is the continuation of I.6, 75a28-37 since Zabarella included this part to I.7. Additionally, Steinkrüger believes that John Philoponus, the Neoplatonist philosopher also thought as Zabarella. He outlays several pages to prove that Philopunus thought I.6, 75a28-37 and I.7, 75a38-39 as a single part [14: 87, 157]. Evidently, this division into chapters was not made by Aristotle himself. Therefore, by comparing this part of the Posterior Analytics with its Arabic commentaries, particularly Avicenna's Kitāb al-Burhān (Book of Demonstration), I will argue that it should be placed it on its own original textual context, and established as a consequence of the preceding chapter.

The theory of Aristotle's kind-crossing was introduced in its Arabic commentaries, e.g., in al-Fārābī's Kitāb al-Burhān as 'transferring the demonstrations from one science to [another] science' (naql al-barāhīn min sināʿa ilā sināʿa) [10: 320], in Avicenna's Kitāb al-Burhān: 'shifting the proof from science to [another] science' (naql al-burhān min 'ilm ilā 'ilm) [3: 169] in Averroes's Talkhīs al-Burhān: 'absence of the relationship between the genera' ('adam at-tawāsul bayna al-ajnās), 'transition of demonstration from one genus of the sciences to another genus' (naql al-burhān min jins min al-'ulūm ilā jins ākhār), [2: 67] and in Tafsīr al-Burhān: 'shifting from one genus to another genus' (al-intiqāl min jins ilā jins ākhār) [2: 275]. It is noteworthy that Avicenna and Averroes, opposed to Aristotle's Neoplatonist commentators, even devoted a separate chapter to this problem.

When we look particularly at Avicenna and Averroes's Burhāns, we can clearly see the cut between I.6 and I.7 in the modern editions of the Posterior Analytics:

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Aristotle, *Posterior Analytics*	Avicenna, *Burhān*	Averroes, *Tafsīr al-Burhān*
I.6 Hence the middle term must apply *per se* to the third term, and the first *per se* to the middle. I.7 Therefore it is not possible to prove a fact by crossing from one genus to another.	When the middle term belongs *per se* to the minor term, and the major term belongs *per se* to the middle term, it is not possible to cross from one science to another science.	Therefore the major term must hold of the middle term *per se*, and the middle term must hold of the minor term *per se*. In that case, it is not possible to transfer the proof from one genus to another genus.

It can be presented in a syllogistic form; however, it raises even more questions:

(P1) The middle term must belong to the minor term per se

(P2) The major term must belong to the middle term per se

(C) It is not possible to cross from one science to another science.

One may find problematic to present it in a syllogistic form and have an objection and even argue that we are mistaken by treating it in this way. Because, if it indeed could be considered as a syllogism, the conclusion should be not 'Therefore, it is not possible to cross from one science to another science', but 'Therefore, major term also must belong to the minor term per se'. However, Avicenna and Averroes force us to read it in a syllogistic form. But the question still remains: what is the tie between having essential relationship of those three terms between each other and the prohibition of kind crossing and the demarcation of the sciences? Hence, it should be shown how exactly the foregoing argument touches on the kind-crossing prohibition as well as how the argument of I.7 relates to the preceding discussion. Thus, we have to recall Aristotelian notions of the middle term, demonstrative syllogism and per se attributes and Avicenna's commentaries on them. In the remaining pages we will establish that it must be considered as a consequence of the foregoing consideration. Moreover, we will argue that despite Aristotle's all efforts to strengthen his concept of ban on kind-crossing, even he himself could not avoid it.

3. Aristotelian Notion of the Middle Term, Demonstrative Syllogism and per se Attributes

According to Aristotle, in a demonstrative syllogism, in order for a conclusion to necessarily follow from the premises, it is necessary to have a middle term and, therefore, at least two premises. Because, says Aristotle, an explanation of the type 'if something holds it is necessary for this to hold' occurs not when a single premise is assumed but only when there are at least two. This is the case when the premises have a single middle term. Thus, when this one item is

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assumed, it is necessary for the conclusion to hold [II.11, 94a24-26]. For Aristotle, the middle term is not just a term that appears in both premises and absent in conclusion. In the analytic syllogism, it must express an internal reason, on the basis of which in conclusion a connection is established between two extreme terms. If we want our conclusion to be of the necessary character, the necessary connection must be established between the terms, namely, the middle term must essentially belong to the major term, and the minor term to the middle [I.6,75a35-38]. Aristotle proceeds from the matter that since in each kind whatever holds of something in itself and as such holds of it from necessity, it is clear that scientific demonstrations are concerned with what holds of things in themselves and that they proceed from such items [I.6,75a29-30]. According to Aristotle, all three terms must refer to the same genus, and in the premises be in relation to the genus and species, i.e. they must hold of their subject in virtue of its essence and in virtue of its form. Its position in the perfect syllogism reflects its position in the hierarchy of the genus of the essence, and in it the middle term is not only by position, but also by nature is middle. A perfect syllogism has the necessary character precisely because it reproduces the necessary (internal causal) connection of the kinds of the essence, and not by virtue of formal conditions. Aristotle understands the demonstration somewhat more broadly than simply as 'demonstrative syllogism', that is as the 'basis of the accuracy and conviction of a fact' [I.2, 72a25]. Aristotle is interested, first of all, in the analytical demonstration which provides the necessary knowledge. Therefore, at the beginning of his research, he defines demonstration as 'a syllogism which produces scientific knowledge' [I.2, 71b17]. Knowledge and its object differ from opinion and its object in that knowledge is of the universal and proceeds by necessary propositions, and which necessarily cannot be otherwise. Aristotle considers 'necessity' as a distinguishing feature of the demonstration [I.6, 74b16-17], since 'if something demonstrated, it is impossible to be otherwise' [I.6, 74b8-9]. This knowledge will be absolutely necessary only if we explicate all the reasons that led to it, and show that it necessarily arises from the true, necessary first principles. The subject of the demonstration can be only the so-called 'intermediate things' i.e. those that can occupy the place of the subject and predicate in the premises [APr. I.27, 43a44-45]. But among this "intermediate", he emphasizes that which holds of 'accidentally' and that which holds of 'necessarily'. Only essential attributes are necessary to their subjects [APo. I.6,74b7]. Aristotle describes one thing as 'belonging per se' to another if it is an element in the essential nature of the other [I.4, 73a34-37]. He indicates that since in each genus it is the attributes that belong essentially to that particular genus that belong to it of necessity, it is evident that scientific demonstrations are concerned with essential attributes and proceed from them [I.6, 75a28-30]. All the terms used in the demonstration must refer to the same genus. The demonstration is carried out strictly within the framework of one genus and its task is to identify the properties of this genus that belong to it essentially [I.7, 75b1-2]. Such analytical demonstration, if it claims to be necessary, should be carried out 'by adding a term internally, and not externally' [I.22, 84a34-35].

Hence, we may see that the main aim of Aristotle's all above-mentioned statements on the notions of middle term and per se belonging was to avoid regress to infinity and substantiate the necessary character of the demonstration, and consequently he significantly limited the scope of the demonstration. This restriction led to a sharp distinction between arithmetic and geometry. Actually, Aristotle's separation between

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these two disciplines was a conclusion of a long discussion started in I.5 where he refers to Eudoxus' general theory of proportion, remarking that the theorem about alternating proportions was once proved separately for numbers, lengths, times and solids because these were not named under a single genus. Eudoxus grouped all of these under a single comprehensive term and this somehow made possible a general theory of proportion in which certain properties can be demonstrated to belong to all of them per se [8: 182]. Thus, we may assume that despite [I.7, 75a38-39] applies to the discussion in [I.5, 74a18-24] it can be also considered as a conclusion of [I.6, 75a36-37]. In any case from Avicenna and Averroes's text we may suppose that they understood it in this way. Therefore, we may proceed to discuss the reasons that led Avicenna to unify [I.6, 75a36-37] and [I.7, 75a38-39] as well as his concept of kind-crossing prohibition.

4. Avicenna on Kind-Crossing Prohibition

According to Avicenna, transferring the demonstration occurs in two cases: (1) when one thing will be taken as a premise in one science and its demonstration will be in another science. Hence, it will be received in this science and its demonstration will be transferred to that science; (2) when one thing will be taken as a required thing in one science, and then it will be proved by the demonstration the middle term of which is from another science. Therefore, the parts of the syllogism will be valid to take place in two sciences [3: 169]. Case (1) directly points to kind-crossing prohibition rule, and (2) to the subordination relation.

As it was noted above, although Avicenna devoted a separate chapter to this subject, Aristotle's kind-crossing prohibition rule he first introduced in II.5 where he following Aristotle, says when the middle term is essential for the minor term, and the major term also belongs per se to the middle term, it is not possible to cross from one science into another one. Rather, every science is demonstrated by its own proper principles, like geometricals by the demonstrations proper to geometry, and the arithmeticals by the demonstrations proper to arithmetic. Thus, nothing could be included from the transferred or distant demonstration to any part of the science, except the common thing. Thereby, the premises must correspond to the conclusion [3: 154]. Avicenna, following Aristotle's distinction of arithmetic and geometry, says [3: 170] that two sciences with different subject matters or different methods of study of subject matter cannot unite in the case (1) of demonstration transfer. Two different treatments of two sciences with different subject matters and accidents cannot unite with each other. Any science does not deal with distant accidents and with the accidents which do not belong per se to the thing. For instance, arithmetic takes a number and geometry a magnitude as a general genus and do not trespass them [3: 147]. Consequently, Avicenna criticizes the philosophers who compiled the geometricals from the arithmeticals and made arithmeticals the principles of geometricals [3: 188, 4 I: 94].

First, let's consider the meaning of belonging of the middle term per se to the minor term and the major term to the middle. In Burhān, Avicenna provides a good example. He assumes 'having an internal angle-sum equal to 2R' to be a middle term, 'triangle' a minor term, and 'having an internal angle-sum equal to a half of angle-sum of the quadrilateral' a major term [3: 91]. We may present it in a syllogistic chain:

(P1) An interior angle-sum of a triangle which is equal to 2R makes it also equal to the half of the interior angles of the quadrilateral.

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(P2) Triangle is a figure the interior angles of which have a sum equal to 2R.

(C) Triangle is the figure a sum of interior angles of which is equal to the half of the interior angles of the quadrilateral.

The middle term 'having an interior angle-sum equal to 2R' in the above syllogism constructed from Avicenna's examples is truly per se attribute of the minor term 'triangle' as well the major term 'sum of the interior angles of the triangle is equal to the half of the sum of the interior angles of the quadrilateral' is per se attribute of the middle term. Therefore, we can assume in Aristotle's notion that it is a scientific syllogism. This syllogism is related to the 'triangle' which is the subject matter of the geometry and does not exceed the boundaries of the per se attributes of the triangle. In the same way, nothing is subjoined to the triangle which does not belong to it per se, and the demonstration is made up inside the domain of geometry.

One of the famous geometrical problems, the squaring of the circle is an example that illicit kind-crossing, according to Aristotle, is impossible not solely between the sciences with different subject genus but also within the same discipline. In the Physics VII.4, 248b6 he prohibited the comparison between circular and rectilinear motions as involving an illicit transition because 'circular' and 'rectilinear' belong to different kinds of things. Aristotle may have had in mind the problem of Bryson's and Antiphon's attempts to square the circle, since in APo. I.9, 75b39-44 and Physics I.2, 185a14-17 he rejects them on the grounds that they were based on a logical fallacy, because of their failure to limit the premises to the subject genus studied by geometry. The reason of the impossibility of measuring the area of the circle with quadrilateral or polygon is probably because 'circle' and 'quadrilateral' and respectively 'circular' and 'rectilinear' have a different nature, and the essences of the 'rectilinear' and 'circular' lines that generate these figures are also different. For Avicenna, 'rectilinearity' and 'circularity' apply to the nature of the line in a primary way… and if the matter in each of them does not have this attribute by which the line of [each] becomes either rectilinear or circular, then that very line itself would not exist [6: 415-416]; hence, rectilinear' does not coincide with 'circular' [6: 425]. Moreover, 'rectilinearity' and 'circularity' do not admit increasing and decreasing, e.g., by leading 'rectilinearity' gradually into 'circularity' or 'circularity' gradually into 'rectilinearity' [6: 495]. This also means that Avicenna, following Aristotle, does not accept the method of exhaustion of measuring the circle by quadrilateral or polygon. He claims, if the circle is divided in actuality into segments, the unity of its surface ceases to be and it ceases to be a circle. For the circumference would [no longer] be one line in actuality, but many [6: 191]. The problem of the impossibility of the measuring the rectilinear and circular lines seems to be crucial also in the example of the healing of circular wounds which will be discussed latter.

According to Avicenna, the sciences are either particular or general. The reason why some kind of particular science should be considered as particular is because there will be supposed to be a subject matter that deals with the things which belong per se to that subject. Otherwise, the particular science will not be particular; in contrast, every science mix with each other. So, the investigation will not be on a particular subject, on the contrary, on the general being. Therefore, particular science becomes general and the sciences will not be separated from each other. Thus, if an arithmetician starts to deal with the number in the sense that it is a quantity, or the geometer treats the magnitude with respect to quantity, the subject matter

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of each of them will be a quantity, not number and magnitude. Thus, a human body, the subject matter of particular science, e.g., a medicine, we may assume an accident which does not apply per se to human body, e.g., absolute darkness or absolute motion. Absolute darkness applies to human body with regards that it is a compound body, and the motion in terms that it is a natural body. Therefore, medicine becomes not particular, but general science like physics [3: 133].

Hence, there is only an appropriated thing in the demonstrative sciences that falls under the domain of that science and which is either a subject matter and derived from it or principles of subject matter. The difference of the subject matters of the sciences is either an unqualified difference without any mixing or with some kind of interrelationship by mixing. So, the demonstrations investigate only per se attributes of the subject matters and these attributes exist solely in the subject matters and in the genera of the subjects.

Avicenna states that transfer of the demonstration can occur only when one science is subordinated to another one [3: 169]. Potentiality is the per se attribute of the being, so it is transferred from the superior science which investigates universal being and what pertains to it essentially, to the sciences which deal with the things under the being i.e. if the middle term comes from another genus, it should be from superior genus and be transferred to the subordinated one, because the middle term is essential in the superior science and that is why we obtain per se causes there [3: 177]. Therefore, the demonstration can be transferred only from the superior science to the subordinated science, and thereby general science gives causes to the particular science.

5. Strict Observance of the Appropriate Scientific Method

Avicenna, throughout his corpus, frequently points to illicit relation between such particular sciences like arithmetic and geometry and more general sciences such pure mathematics and natural science. When he discusses the proportions between 'seeing' and 'seen' in the commentary of Aristotle's De Caelo he once more emphasizes the distinction of mathematics and natural science. According to him if 'seeing' and 'seen' could be proportional they should have remained proportional while replaced with each other, and hence there was no need to demonstrate them. However, this matter needs to be demonstrated, so if it is demonstrated basing on one of its genera then there would be demonstration of similar things that were included in other genera, as if something is demonstrated in geometry there was no need to demonstrate anything in arithmetic. However, for Avicenna this is not the case, on the contrary, the demonstrator needs to renew a demonstration on it in arithmetic, since if it was possible to demonstrate something both in geometry and arithmetic, there was no need to demonstrate and accept anything in natural things. However, Avicenna maintains that in natural things it is not necessary to have proportions like in numbers and magnitudes with regard to being natural, and not in respect of being measured and counted. Accordingly, even if there is some kind of proportion between magnitudes and numbers, it is not necessary that this proportion is maintained in all the natural things in genus, apart from a kind [6: 39-40].

Avicenna provides another example of the case of the sphere, which meets a flat surface at a point if we are to believe the musings of the mathematicians. However, to claim that this happens in physical reality is a mistake:

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This makes the laws of nature dependent upon certain mathematical abstractions of the estimative faculty, which is not right. In fact, beyond going outside the discipline [of physics], that [argument] doesn't even entail what [they] wanted it to prove, but only requires that the continuity of the two designated motions be in the estimative faculty. We, however, don't deny that that continuity is in the estimative faculty. We deny only that only of the natural things that deviate from the abstractions of the estimative faculty [6: 456].

This broadly conforms to the traditional Aristotelian contention that the mathematical sciences have solely a tangential relation to the natural ones. The relation is strictly one-sided, inasmuch as what is physically possible must be mathematically possible but the reverse need not be the case, that is, not everything that is mathematically consistent will find physical instantiation.

Moreover, in the issue of the proof of the uniqueness of the world, which Aristotle establishes in De Caelo I. 8-9, Avicenna says that most people have claimed that there are many universes. Some of them have turned to this view because of the wrong method but proper to natural science, and some because of a wrong method which is not appropriate for natural science but philosophical and logical [6: 70]. This shows that Avicenna comprehensibly underlined the necessity of compliance with proper scientific method.

6. Excluding the Categories from Logic

According to Avicenna, the place where the categories should be studied is not the science of logic but metaphysics. For this reason, he does not include categories in his Remarks and Admonitions. Avicenna thinks that it is not necessary for the categories to be addressed in the science of logic both in terms of subject matter and in the ease of teaching. He also echoed al-Fārābī in questioning the appropriateness of placing the Categories within the Organon, and decided that it should only be treated within the other logical texts due to immemorial custom. But it is no help in understanding the syllogism [15: 541]:

The student of logic, after learning what we have told him about regarding the simple terms, and learning the noun and the verb, can go on to learn propositions and their parts, and syllogisms, and definitions and their kinds, and the matters of syllogisms and the demonstrative and non-demonstrative terms and their genera and species, even if it does not occur to him that there are ten categories. However, the student by learning the categories can benefit from them in order to implement some things [3: 5].

Avicenna makes statements about what sciences are related to the categories:

Then you must not exceed the measure of learning this art [i.e. categories] because of your ambition, and make sure that it is actually introduced into the art of logic from the outside. You have to know one more thing: No one has put this book in the logic, with the aim of teaching, but rather with the purpose of circumstance and imitation, since it is not possible to know what is known in the categories through investigation by logical explanation. You should know that their all efforts to prove the number of these ten categories, and that there are no knowledge of them, and not have an overlapping between each other; each of them has some kind of property; nine of them are different from the first which is the substance and those nine are accidents. These are explanations derived from other disciplines and are completely incomplete. Because these can only be known through a depth examination and the in-depth examination is made only after reaching the level of science named First Philosophy [3: 6].

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As it can be seen, Avicenna excludes the Book of Categories from logic and constantly emphasizes that what is dealt with in this book should be discussed in metaphysics, not in the science of logic. The knowledge of the categories regarding their properties is the knowledge of metaphysics; regarding the soul's imagination of it is the knowledge of psychology, and the knowledge of them regarding their signification of the utterance, is the knowledge of linguistics. Therefore, while categories can be subject to different sciences from different aspects, they do not provide much benefit with regards to logic [16: 65]. Moreover, according to Avicenna, it would be wrong choice to start learning with the Book of Categories. Since the problems discussed in this book are the subject of metaphysics, it is harmful for the student to start the science by trying to learn the categories:

However, we say what we have expressed before, and then we will follow the paths and traditions of the logicians, whether we accept them or will be descriptive, and for this purpose, we say: This book [The Book of Categories] and its putting at the head of the logic is not so helpful, rather too harmful at the beginning of learning. I have seen so many people whose souls had gone confused because of reading this book so they even imagined unrealizable things in this book and even dreamed of things that have nothing to do with the truth [3: 8].

As it can be understood, Avicenna proposes different views on the order and place of the Book of Categories in logic and philosophy and excludes the categories both from logic and learning. Ibn Khaldun's statements that later scholars dropped the Categories because a logician is only accidentally and not essentially interested in that book show that Avicenna's removal of the categories from his logic books, and the method by which he investigated the context theory were influential [15: 541].

7. The Problem of Circular Wounds

Aristotle talks about the relation between the medicine and geometry in the Posterior Analytics:

Many sciences which do not fall under one another are in fact related in this way – e.g. medicine to geometry: it is for the doctor to know the fact that circular wounds heal more slowly, and for geometer to know the reason why [1:14].

Aristotle obviously means the differentiation between knowing the fact and knowing the reason when he says that there are sciences that are 'related in this way'. But medicine and geometry in the given example of the healing of circular wounds are the sciences which are 'not related in this way'. Steinkrüger says because a circle has the greatest area in relation to its perimeter, the closing of a circular wound will take longer than the closing of a wound in the form of a slit. And while the doctor knows from experience that circular wounds heal slower than other wounds, he does not know the theorem about the relation of the area and the perimeter. However, it is also not purely accidental that circular wounds heal more slowly than other wounds. Steinkrüger finds detailed clarification difficult since Aristotle does not say more about this particular aspect of his theory [14: 115-116].

I think by stating that 'many sciences which do not fall under one another (i.e. besides that of geometry and medicine) are in fact related in this way' Aristotle himself left the door open for violation his prohibition rule and wordlessly assumed that it should not be accepted in a strict sense and there are other many interrelationships of this kind between the sciences except medicine and geometry. Barnes also argues

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that Aristotle's this example violates the thesis of I.7 [1: 160].

Aristotle's this confused example made Avicenna to substantiate the relation between these two disciplines as a regular subordination. Actually, first, he believes that the conformity of the demonstrative premises with the conclusion is one of the conditions of not occurring of the illicit kind-crossing. According to him, the inference of the doctor that the circular wounds heal more slowly because the circle is the most encompassing figure, is the true conclusion which constructed by the true premises that in fact were not corresponded with the conclusion. Avicenna does not consider this syllogism true [3: 106], since the premises are not correlated with the conclusion, forasmuch as there is used a major geometrical premise to demonstrate a matlūb that falls under the domain of the physical sciences and the proper cause was not assigned. Thus, being proper means the premises of the demonstrative science not to be from the foreign science because the predications should be per se. The demonstrative premises are the causes of the conclusion, and the cause is somehow correlated with the causing thing. Therefore, a doctor when states that 'the circular wound heal more slowly than the linear one, because the circle is the most encompassing figure', he does not bring the demonstration from the medicine [5: 106].

However, as it was noted above, Aristotle did not say more about this particular aspect of his theory, and it made Avicenna face some kind of difficulties. He could not pass by not explaining this issue, and found the clarification 'it is not a true demonstration since the premises do not correspond with the conclusion' insufficient whereas from Aristotle's expressions it might be reasoned as a true demonstration. Moreover, he could not directly criticize Aristotle as he did not clarify it distinctly. Consequently, Avicenna, in the following pages of the Burhān, quietly opposing to his previous clarifications, in some respect synthesized geometry and physics to make geometry give the reason of healing of circular wounds more slowly than the slit one. He says that 'there can be given a cause combined from natural science and geometry by saying that since healing moves to the centre, so, if there is found an angle, the direction of the move can be determined, and thereby the conjunction becomes easier. But if, there is not found an angle, the motion will be extended to the all perimeter, and the parts will withstand and the healing will become slower' [3: 208]. Again, we can consider it in a syllogistic form:

(P1) Since the move of the healing is in the direction of the centre if there is found an angle the healing will become easier.

(P2) There is no an angle in the encompassing figure, the circle.

(C) The healing in the circular wounds will not become easier.

As we can see (P2) is a completely pure geometrical premise and does not have a relation to a medicine at all. Avicenna's this statement absolutely refutes his all own arguments on canons of demonstration developed in Burhān and his claims in Physics where he says that pure geometry and natural science do not share in common the same [set] of questions [6 I: 54], and in Metaphysics where he criticizes ancient Greek philosophers on account of crossing from sensible things into the intelligible ones [4 II: 310-316]. It is also surprising that Avicenna completely did not deal with this matter in his Canon of Medicine. We may just assume that Avicenna probably thought that there is no a medical explanation of it, and hence the reason of

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the healing of circular wounds more slowly was explained by this kind of particular view.

8. Widening the Boundaries of the Canons of Demonstration

In the Remarks and Admonitions, Avicenna claims that there can be a demonstration on rare things without making a distinction between a possibility and existence, and criticizes those who think otherwise:

The scientific inquiries may be the result of the necessity of a judgment, the possibility of a judgment, or the absolute existence, in a non-necessary sense / as is the knowledge of the states of the conjunction and opposition of the stars. Every genus [of these inquiries] has its proper premises and conclusion. Similarly, the demonstrator infers the necessary from the necessary, and the non-necessary from the non-necessary, be that mixed or pure. Therefore, do not pay heed to him who says that the demonstrator does not employ, except necessary propositions and those that are possible in the majority of cases, without others. Rather, if he wishes to infer the truth of a possible in a minority of cases, he uses the possible in a minority of cases. And in every type [of inquiry] appropriate [premises] are used. Nothing but this has been stated by earlier scholars, but in a manner overlooked by recent ones. That is the earlier scholars said that in demonstration the necessary conclusion is inferred from necessary propositions, / and in other than demonstration it may be inferred from non-necessary propositions. Nothing was intended but this. Or what was intended is that the truth of the premises of the demonstration is, in their necessity, possibility or absoluteness, a necessary truth. When 'necessary' is stated in the book On Demonstration, what is intended by it is that which is common to the necessary, mentioned in the book On the Syllogism, and that whose necessity endures as long as the subject remains qualified by that which qualifies it; and not the pure necessary [4: 150-151].

According to Naṣīr ad-Dīn Ṭūṣī, who studied this passage of Avicenna in more detail, the things investigated in the sciences are divided into three: necessary (having the angles in the triangle), just possible (recovery of the tuberculosis) and existential (eclipse of the Moon). However, Ṭūṣī says if we consider not the mode of possible proposition but the judgment itself, the possible proposition also will be accounted as a necessary type. In other words, if the aim of the proposition is the judgment of the possibility itself, the proposition becomes necessary. If Ṭūṣī's interpretation is correct, it means that there is a difference of opinion about whether or not there can be a demonstration about minority of cases between ash-Shifā', an-Nadjāt in one hand and Remarks and Admonitions in the other. For as much as Avicenna in ash-Shifā', an-Nadjāt says that there can be made a demonstration solely of majority of possible cases, while in Remarks he claims that a demonstration also can be constituted on minority of cases and even criticizes former logicians who objected to this view [17: 215].

According to Avicenna, the words which were interpreted mistakenly by former logicians are Aristotle's statements that "a demonstration is a syllogism formed from scientific premises to achieve a precise conclusion". Most of the latter logicians understood this phrase as "the demonstrator can use only necessary premises". However, when they saw that those who were engaged in natural sciences inferred non-necessary conclusions from non-necessary premises, they thought that the majority of possible cases can be used in the syllogism. According to Avicenna this is not true, because the demonstrator aims to achieve certainty in every judgment and there

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is no difference between the necessity and non-necessity in the judgment. In this respect, each judgment is inferred from the premises that correspond and related to it [17: 216].

In general, Avicenna's view is that all types of the existential propositions can be used in the demonstrations, but with their own characteristics, they express an accuracy and certainty. Avicenna, although in the Commentary of the Posterior Analytics said that the demonstrative premises must be per se and proper, in Remarks, he widened the area of the scientific research by widely defining 'being related' and argued that non-per se accidents also can be used in the demonstrative premises if they are suited to the subject matter [17: 217].

The binding of the predicate with the subject matter or of the premise with the conclusion means the removing of the distance between the subject and predicate or the premise and the conclusion. Due to the binding, a non-per se accident becomes proper to whatever it is used, and the alienation and distance of the accident cease. In other words, the perspective makes non-per se accident essential and proper. Therefore, the binding of the predicate to the subject matter expands the area of certainty which is narrowed by per se and proper definitions [17: 226-227].

The making a demonstration on any issue does not guarantee that the subject is fully known even from the direction of the demonstration by which it was formed. Because the scope of the demonstration is so broad that it includes things that are related to the subject matter and there is no certainty that it would be impossible to think in the whole of this large area which is dependent on a significant degree of data. For this reason, Avicenna in two places of the Book on Demonstration criticizes those who claim that the demonstration is generated only on the basis of per se attributes and that the theory of demonstration must not be overestimated [17: 238-239].

Concluding Remarks

We may conclude that (1) Avicenna (and even Averroes) indicates to unify the gaps between I.6 and I.7 of the modern editions of the Posterior Analytics, (2) Aristotle's prohibition may also be understood not in a very strict sense, furthermore, Aristotle and Avicenna themselves permitted some kind of violation and thereby allowed to widen the area of the application of demonstration.

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