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# Suárez on sound and hearing

*Suárez sobre el sonido y el oído*

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**Abstract:** The author analyses Suárez's theory of sound and hearing as presented in the sixth, eighth and ninth questions of the seventh disputation of the Jesuit's *Commentary on Aristotle's De anima*. In the study, Suárez's stances to the following issues are laid out: 1) the nature, cause and subject of sound; 2) the kinds of media of sound and the manner of its dilatation *in medio*; and 3) the organ of hearing.

**Keywords:** Suárez, sound, air, Aristotle.

**Resumen:** El autor analiza la teoría de Suárez acerca del sonido y el oído tal como es presentada en las cuestiones sexta, octava y novena de la disputa VII del Comentario al *De anima* de Aristóteles. En este estudio se exponen las posiciones de Suárez sobre los siguientes temas: 1) la naturaleza, causa y sujeto del sonido; 2) los tipos de medio del sonido y la manera de su expansión *in medio*; y 3) el órgano del oído.

**Palabras clave:** Suárez, sonido, aire, Aristóteles.

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## INTRODUCTION

From the viewpoints of history of philosophy, history of science and history of ideas, the sense of hearing was always regarded as “the second sense”.<sup>1</sup> The majority of philosophers and scientists since ancient times up to the modern period, with very few exceptions,<sup>2</sup> considered aural perception to be “small brother” of visual perception. This evaluation can be confirmed in many ways, first of all from the origin of the corresponding sciences. Unlike optics, which got its *impetus* from the work of the Arab scientist, mathematician and philosopher Alhazen (965-1040), acoustics, as physiological and psychological exploration into the sense of hearing,<sup>3</sup> did not become a freestanding science until the 17<sup>th</sup> century when it started to get its shape in the works of Galileo Galilei (1564-1642) and Marin Mersenne (1588-1648).<sup>4</sup> In medieval and renaissance philosophy, the privilege of *visio* was commonly substantiated by the following reasons: light (*lumen*), as the object of vision, is the noblest quality of all the proper sensibles; sight attains a greater distance than hearing; unlike hearing, vision operates in no time; the so-called common sensibles, i.e., figure, magnitude, rest, motion and number, are best perceived by sight; the eye is the most perfect and admirable organ; etc.<sup>5</sup> Despite this “visuocentric” approach in

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1. See the eponymous collection of essays Ch. BURNETT, M. BEND, P. GOUK (eds.), *The Second Sense. Studies in Hearing and Musical Judgment from Antiquity to the Seventeenth Century* (The Warburg Institute, University of London, London, 1991).
  2. An exception is the French philosopher and mathematician Charles de Bovel (1479-1566). See T. FRAGENBERG, *Auditus visu praestantior: Comparison of Hearing and Vision in Charles de Bovel's Liber de sensibus*, in Ch. BURNETT et al. (eds.), *The Second Sense* cit., 71-94.
  3. The name of this new science was coined by Samuel Reyher in his *De natura et iure auditus et soni*, published in 1693. For this see M. WITTMANN, *Vox atque sonus. Studien zur Rezeption der Aristotelischen Schrift „De anima“ und ihre Bedeutung für die Musiktheorie* (Centaurus-Verlagsgesellschaft, Pfaffenweiler, 1987), Erster Band: Studien, 271. Of course, it cannot be denied that the mathematical study of harmony and research into architectural acoustics goes back to the ancient times with the names of Pythagoras and Vitruvius. Yet, acoustics as a complex *psycho-psychological* enquiry emerged in the period of the scientific revolution in the 17<sup>th</sup> century.
  4. Cf. Ch. BURNETT et al. (eds.), *The Second Sense* cit., 2.
  5. All these and other arguments are commonplace in the theory of perception in the

the scholastic tradition, the second-class position of hearing did not mean that scientific and philosophical enquiries into hearing and sound (*sonus*) were of an entirely derivative character.<sup>6</sup> The ontological issue of the character of *sonus* constitutes an important challenge for the Aristotelian theory of perception, for at least two reasons. First, more than in the case of colour, some of Aristotle's formulations concerning the ontological status of sound seem to suggest a reductionist conception of sound. Accordingly, the proper sensible of hearing is to be reduced to the common sensible, namely to the motion of air.<sup>7</sup> Second, in *De anima*, Aristotle is clear that sound *in actu*, as in its subject, resides not in the sensibles themselves, which produce sound by mutual percussion, but only in air. In the sensibles it exists only *in potentia*.<sup>8</sup> This statement can be taken as standing in tension to the Aristotelian claim according to which most of the real (patible) qualities of the external senses *in actu* indwell in the material substances of *which* they are accidents.<sup>9</sup>

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medieval and renaissance scholastic philosophy. The roots of this view can be found already in Plato and Aristotle. In Plato's *Timaeus* we read: "Vision, in my view, is the cause of the greatest benefit to us, inasmuch as none of the accounts now given concerning the Universe would ever have been given if men had not seen the stars or the sun or the heaven." PLATO, *Plato in Twelve Volumes*, Vol. 9, transl. by W. R. M. Lamb (Harvard University Press, Cambridge, MA; London, William Heinemann Ltd., 1925), *Timaeus*, 47a. In the famous passage in the prologue to *Metaphysics* Aristotle says: "... most of all [we esteem] the sense of sight ... of all the senses sight best helps us to know things, and reveals many distinctions", ARISTOTLE, *Metaphysics* (Harvard University Press, Cambridge, MA, 1933) 3, 980a24-8, 3. For a "catalogue" of the reasons for the priority of sight, and the second position of hearing, see F. SUÁREZ, *Commentaria una cum quaestionibus in libros Aristotelis "De anima"*, in S. CASTELLOTE (ed.), Tomo 2 (Editorial Labor, Madrid, 1981) disp. VII, q. 16, nn. 2-3, 764-8 (further only: *DA* VII, 16, 2-3, 764-8).

6. Moreover, a certain aspiration to the leading status of hearing can be found already in Aristotle: "... hearing makes the largest contribution to wisdom. For discourse, which is the cause of learning, is so because it is audible ... the blind are more intelligent than the deaf and the dumb", ARISTOTLE, *De sensu et sensato* (Harvard University Press, Cambridge, MA; London, England, 2000) I, 437a11-17.
7. ARISTOTLE, *De anima* (Harvard University Press, Cambridge, MA; London, England, 2000) II, 8, 420b11-2: "... sound is a kind of motion of the air"; "... sound is held to be the motion of something travelling ...", *De sensu et sensato*, VI, 447a1-2.
8. "But the sound actually produced is of something striking against something else in a medium", ARISTOTLE, *De anima*, II, 8, 419b4ff.
9. For these two challenges see also R. PASNAU: *Thomas Aquinas on Human Nature* (Cambridge University Press, Cambridge, 2002) 184-6, 189; *Sensible Qualities*:

Suárez takes up these two challenges in *DA VII*, 6-9, where his theory of sound and hearing is systematically presented. The fact that a significant part of *DA VII* entitled “De sensibus exterioribus in particulari” is devoted to the topic of sound and its propagation gives us evidence that Suárez was aware of a certain “regulation” of the dominance of the visual, which is nevertheless underway in *DA VII*. As we will see below, in these questions Suárez advocates what can be called a version of “Sonic Realism”.<sup>10</sup> His realist view of sound seems to be based on two main commonsense statements. First, sounds are extramental, transient (successive) sensible qualities that supervene upon the vibratory movements of bodies disturbing the surrounding (medium of) air. Accordingly, they are not mental items. Second, although the primary subject and the proper medium of *sonus* is air, Suárez thinks that the primary subjects of sounds are the sound producing bodies, or more precisely, their pores, which are filled with air. Importantly, this hybrid theory, which combines the medial tenets and the distal theories of sound,<sup>11</sup> is related to Suárez’s emphasis on “a locational view of sound”, which in his interpretation is closely connected with the endorsement of the audible sensible species.<sup>12</sup>

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*The Case of Sound*, “The Journal of The History of Philosophy” 38/1 (2000) 27-40; *What is Sound?*, “The Philosophical Quarterly” 49/196 (1999) 310-324.

10. For the explicit endorsement of Sonic Realism and for the struggle against “The Tyranny of the Visual” in the recent analytical debate, see C. O’CALLAGHAN, *Sounds* (Oxford University Press, Oxford, 2007).
11. While the medial theories “construe sounds as features of the medium in which a sounding object and a hearer are immersed”, the distal theories identify sounds with “distal properties, processes or events in the medium inside (or at the surface of) sounding objects, or in the stuff of the sounding object”. For a panoramic classification of various doctrines of sound according to the criterion of its spatial location, cf. R. CASATI, J. DOKIS, “Sounds”, *The Stanford Encyclopedia of Philosophy* (Fall 2014 edition), E. N. ZALTA (ed.), <<https://plato.stanford.edu/archives/fall2014/entries/sounds/>>, esp. 2. Medial Theories of Sound; 3. Distal Theories of Sound.
12. Anachronically speaking, a spatial account of sound can be regarded as being primarily focused against a non-locational view of sound, which was the view famously endorsed by Peter Frederick Strawson. In his *Individuals* Strawson says “Sounds ... have no intrinsic spatial characteristics: such expressions as ‘to the left of’, ‘spatially above’, ‘nearer’, ‘farther’ have no intrinsically auditory significance (...). A purely auditory concept of space... is an impossibility.”, P. F. STRAWSON,

In the first two parts of my paper I will consider these two challenges related to the issues of the nature, cause and subject of sound. In the third part, I will present Suárez's theory of the kinds of media in which *sonus* is dilated. Fourth, I will focus on the manner in which sound is spread *in medio*. More precisely, I will focus on the topic of the exact coordination of the natural and intentional *modus propagandi* and *modus multiplicandi* of sound in the medium. Fifth, I will complete my presentation with an outline of Suárez's theory of the auditive organ. In conclusion, I will sum up the representative features of Suárez's theory against the backdrop of his approach to Aristotle.<sup>13</sup>

#### NATURE AND CAUSE OF SOUND

Suárez opens *DA VII*, 6 with the "definition" of sound: "(1) Sound is a sensible quality (2) coming forth from a violent percussion or from the division of a body (3) apt to receive it [this quality]".<sup>14</sup> Distinguishing three parts in it, in the first part Suárez shows that sound is a *qualitas passibilis*, an accident of quality that can be "suffered" and

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*Individual: An Essay in Descriptive Metaphysics* (Methuen, London, 1959) 65. For a brief presentation of this view, see R. CASATI, J. DOKIS, "Sounds", *The Stanford Encyclopedia of Philosophy*, 4. Aspatial Theories.

13. My treatment of Suárez's aural theory will not be comprehensive. In the context of his *DA VII*, 6-9, devoted to hearing, I will focus only on the part introduced in scholastic manuals by the title "De sono". Accordingly, I leave aside the segment called "De voce", in which, among others, the famous phenomenon of echo is treated (*DA VII*, 7). Apart from this, I will not bring in *ex professo* any of the issues connected with the theory of perception, which Suárez examines in *DA V* and *DA VI*. I have elaborated them, e.g., the nature of sensible species and the principles of a perceptual act, elsewhere. See D. HEIDER, *Suárezova teorie vzniku species sensibilis a kognitivního aktu v kontextu středověké a renesanční filosofie*, "Organon F" 22/2 (2015) 229-249; D. HEIDER, *Late Scholastic Debate About External and Internal Senses: In the Direction of Francisco Suárez (1548-1617)*, forthcoming in: S. SCHMIDT (ed.), *The History of Philosophy of Mind between 1300 and 1600* (Routledge, London, 2017); Francisco de Toledo, *Francisco Suárez, Manuel de Góis and Antonio Rubio on the Activity and Passivity of the External Senses*, in D. HEIDER (ed.), *Cognitive Psychology in Early Jesuit Scholasticism* (Editiones Scholasticae, Neunkirchen-Seelscheid, 2016) 38-66, esp. 47-52.
14. "Sonus est qualitas sensibilis proveniens ex violenta percussione vel divisione in corpore apto ad recipiendum illum", *DA VI*, 6, 1, 634.

received by (in) the pertinent sense organ and in the corresponding power. Notoriously, the proper sensible object is (for most scholastics) what distinguishes perceptual acts, which then differentiate the particular senses. Accordingly, sound is not reducible to the common sensible of motion. If it were, it could not differentiate the acts and powers since it could be sensed not only by hearing but by sight and touch as well. This would violate the ontological status of hearing as a distinct power, which, again, would result in the revision of the established number of the external senses.<sup>15</sup> Although Suárez is well aware of Aristotle's statements suggestive of this reduction, the threat of a revision of the common view is the reason why he is quick to reject it. Sound cannot be reduced to the local motion of air since the "ratio" of motion is separable from the "ratio" of sound. If one (motion) exists without the other (sound), the former cannot constitute the essence of the latter. In the context of the implicit dismissal of the Neoplatonic heavenly music ("the music of spheres"), Suárez exemplifies this existence of one without the other by the example of the soundlessly moving planets. Concluding, *sonus* can be only a quality that somehow falls upon (*accidere*) the motion of air.<sup>16</sup>

Having arrived at "the logical genus" of *sonus* (part 1), Suárez approaches the "specific difference" (part 2). Since a noncircular definition of the "differentia specifica" *in unico verbo* is impossible, Suárez gives "a causal definition". In the causal context, Suárez mentions two models. First, sound is caused by the violent percussion of two bodies. On this model, employed by Aristotle, one can think of the example of a ringing bell or of the clapping of hands. Second, sound is produced by the division of a single object, say, by the tearing of paper.<sup>17</sup> While in the first model there is a thing struck (*percussum*), a striker (*percutiens*) and a medium, the second one operates only with a single body in a medium. In line with Aristotle,

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15. *DA* VI, 6, 1, 634.

16. *Ibidem*.

17. Contrary to Aristotle, who only mentions the three-member model in *De anima* II, 8, Suárez, probably following Avicenna, adds a two-member model as well. For Avicenna's innovation see Ch. BURNETT, *Sound and its Perception in the Middle Ages*, Ch. BURNETT, et al. (eds.), *The Second Sense* cit., 43-69, especially 52.

Suárez proceeds with the survey of the physical properties which the sound producing objects have to possess in order to produce sound. Besides violent motion (a slow motion cannot cause a noticeable sound), the most fitting properties are smoothness, hollowness and concavity. These characteristics make objects truly sonorous.<sup>18</sup>

Further, Suárez addresses the issue of the cooperation of the agents productive of sound. How do the forcible contact of bodies and the motion of air causally (or only “conditionally”) concur with respect to the production of sound? In the reply, Suárez starts from the fact that the common sensible of *motus* cannot be regarded as the efficient cause of the proper sensible of *sonus* since motion, like any other common sensible, is a *less* perfect quality than sound. According to the general “axiom” regulating Suárez’s *Commentary on De anima* as a whole, what is less perfect in the *scala naturae* cannot cause what is more perfect.<sup>19</sup> This “maxim” is also the reason why Suárez so often speaks about the “harmony of the powers of the soul”, which interact not causally but indirectly (“a-causally”) by means of being rooted in the common soul. Clearly, this *explanans* is not applicable here. Instead, Suárez employs the *topos* of “latent quality”. Referring to the example of a projectile, say a stone, and the “latent” impulsive quality (*qualitas impulsiva*) imprinted to it, Suárez applies a similar ontological device in the case of the efficient cause of sound too. This time, the quality is called sound generating quality. Contrary to the impulsive quality in the stone which moves the stone without the stone’s being in contact with, say, a (throwing) hand, Suárez locates this sound producing quality in the sound producing bodies. Strictly speaking, only this quality can be considered as the efficient cause of sound. The motion of air can be seen at most as its necessary condition. Despite this “conditional” status, the motion of air is what makes sound a successive or transient entity, which “perdures” through its temporal parts. Unlike colour, sound does not have a fixed and permanent being. It lasts

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18. *DA VII*, 6, 1, 636.

19. For the universal application of this “axiom” in Suárez’s *Commentary on De anima*, see D. HEIDER, *Idea řádu a metodologie Suárezovy psychologie*, “*Studia Neoaristotelica*”, Supplementum II (2015) 103-117.

only as long as the motion of air is being produced by the percussing bodies.<sup>20</sup>

### THE SUBJECT OF SOUND

Having explicated the first two parts of the “definition” of sound, Suárez comes to the third part, which is related to the issue of the subject of sound. What is that body apt to receive sound — the sound producing sensible objects *or* air, commonly considered to be its medium? Aristotle’s view seems to be clear. As said above, at the beginning of *De anima* II, 8, Aristotle distinguishes between potential sound and actual sound. The colliding bodies are the subjects of sound only potentially since they rather are its efficient cause. *In actu* sound inheres only in air.<sup>21</sup> Since the subject of sound must possess the property of agitability, the subject must be, above all, air. Even our ordinary language (this argument is not employed by Suárez) seems to confirm this conclusion: We say “Sound is filling in the air”, “Music filled the temple”, etc. On the other hand, Suárez repeatedly says that we just as much have a clear pre-theoretical intuition for the opposite view.<sup>22</sup> By hearing a certain sound we detect a place from which it comes. If we do not know where our mobile phone is, we ask someone to give us a ring. Consequently, sound cannot have an amorphous location in air but, at least for a while, it must be fixed and located in the sensible object producing it.

Suárez accounts for this conclusion by three arguments. First let us think of two different pairs of percussing bodies, both generating exactly the same motion (undulation) in air. We often experience that though both produce the same motion, the sounds produced by those two pairs of bodies are different. However, if the subject of

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20. *DA* VII, 6, 2, 636-8.

21. ARISTOTLE, *De anima* II, 8, 419b4ff, 109.

22. For this stance and the incoherence of the standard view, according to which sounds exist in the medium, see R. PASNAU, *Sensible Qualities* cit., 36-40; *What is Sound?* cit., 311ff. According to Pasnau, we should adhere to the view that sound exists in the objects by which they were generated, and thus we should understand sounds in the manner of colours.

sound was air, both strokes would have to produce the same sound. This is not the case, though. In order to explain it, we have to “fix” sounds in the sound producing objects themselves. Second, if the subject of sound was air, the motion of air would have to be the full *explanans* of its quality, say loudness. Accordingly, a stronger percussion of air would have to produce a louder sound, a smaller stroke would have to lead to a more silent sound and an equal blow would have to result in an equal sound. Obviously, it need not be necessarily so. A smaller percussion of mallets on a cymbal can cause a louder sound than a stronger strike on, say, a cloth. This shows that their difference can be explained, above all, by the fact that the cymbal and the cloth, and not air, are the pertinent subjects. Third, like a sound produced by the violent discontinuation of parts of air exists in air, so sound generated by the tearing of paper or by the violent discontinuation of parts of the paper must exist in the paper itself as well.<sup>23</sup>

As for most early Jesuits so for Suárez the common view is equal to the true opinion. The common view in this case is the first opinion. Principally and primarily the quality of sound inheres in air since air is the kind of subject primarily moved by the percussion of sound producing bodies.<sup>24</sup> The crucial strategy in his reply to the aforesaid arguments for the opposite view is the following: It is not only and primarily the adjacent or the “extrinsic” air what accounts for the variation in sound, it is also the shape of the bodies and, importantly, the “intrinsic” air that is contained in the pores of the percussing bodies to be considered in the explanation. Accordingly, the subject of sound will not be only the surrounding or the “extrinsic” air but also the air inhering in the sound producing bodies themselves.<sup>25</sup> Admitting this “kind” of air will save the phenomena connected with our intuition about the localization of sounds.<sup>26</sup>

In the remaining paragraphs of *DA VII*, 6, Suárez also raises the issue whether, apart from air, also the other elements, such as

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23. *DA VII*, 6, 5, 642.

24. *DA VII*, 6, 6, 644.

25. This also implies the substantial qualification of the first view.

26. *DA VII*, 6, 7, 644-6.

water, can be the subjects of sound. Though, like Aristotle, Suárez ordinarily names only air, he in no way is about to restrict it to it. Not only air but also water, fire and “washy” or “airy” mixtures such as clouds are the subjects of sound.<sup>27</sup> Without giving any reasons for fire and the “airy” mixtures, Suárez cites from Aristotle’s *De Historia animalium* to justify that also water is the subject of sound. In the eight chapter of the fourth book of this text Aristotle says that, besides air, water can also become the subject of sound. Fish swimming at the bottom of the sea flee from oncoming ships and oars, which can be explained only if underwater they hear the sounds produced by the ships and oars.<sup>28</sup> Suárez concludes that although Aristotle usually names only air, he is far from asserting that only air can be the subject of sound. What he is after is to say that air is its most fit subject.

#### KINDS OF MEDIUM

Suárez’s solution to the issue of the subject of sound determines his stance to the query about the medium, of which he says that it must be the *plenum* extended between the sound generating object and the auditory power.<sup>29</sup> If sound can be produced in water, fire and the “airy” mixtures, all being elements and mixtures of significant tenuity, the same entities are to be conceived as media of sound too. Despite this obvious determination, Suárez adds two other (partial) analyses. First, although he concedes to the view that water is the subject of sound, he is also aware of Aristotle’s weak textual evidence in *De anima* for the claim about the “medial” character of water. Second, dealing with the issue of the “list” of the media of sound’s dilatation, Suárez asks whether terrestrial and most dense bodies (*terrestria et densissima corpora*) can transmit sound as well, or not.

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27. *DA* VII, 6, 10, 648-650.

28. ARISTOTLE, *History of animals*, transl. A. L. Peck (Harvard University Press, Cambridge, MA; London, England, 1970) book IV, cap. 8, 63, 533b4ff. This substantiates not only the fact the water is the subject of sound but also that sound can be dilated in water as in its *medio* (for this see below).

29. Importantly, *vacuum* cannot be the transmitter of sound. See *DA* VII, 8, 668.

In the analysis of the first topic, Suárez refers to the following *passus* from Aristotle's *De anima* II, 8:

The medium in the case of sound is air, but in the case of smell has no name; for air and water have certainly a common characteristic, which is present in both of them, and bears the same relation to that which emits smell as the transparent does to colour" (419a33-4).

Here Aristotle differentiates between the medium of sound and that of smell by saying that while air and water are the kinds of media in which fragrances get propagated, air is the only medium for the spreading of sounds. Yet, provided that sound can be dilated also in water, as said in *De historia animalium*, this "locus sane difficilis" cannot be explained away by the above employed strategy that the reason why Aristotle mentions only air is to highlight its status of the *best* medium. In fact, fragrances can be best spread in air too, and yet Aristotle mentions water there as well.<sup>30</sup> Interestingly, Suárez's solution to the textual discrepancy is similar to the theory of Pietro d'Abano (1250-1316), laid out in his *Expositio Problematum Aristotelis*. For d'Abano *sonus* can be heard in water assuming that water has not entered the deeper parts of the percipient's ear.<sup>31</sup> If it has, it could not be heard. This makes also the difference from fragrances, which can be smelled even though water gets into the intrinsic parts of nose.<sup>32</sup>

The "medial" elements and mixtures must be of high "raritas". Obviously, such "penetrability" does not exist in earthy objects. However, despite their density, which seems to point to a negative reply to the question, Suárez explicitly asks whether these objects can be-

30. *DA* VII, 8, 3, 664.

31. For this cf. Ch. BURNETT, *Sound and its Perception in the Middle Ages*, in Ch. BURNETT et al. (ed.), *The Second Sense* cit., 43-70; 55. As regards the organ of hearing see Part 6. For another doctrinal affinity with d'Abano concerning the *qualitas dolorifera* as the proper sensible of the sense of touch, see D. HEIDER, *Suárez on Pain and Touch*, forthcoming "Pensamiento", 2017.

32. *DA* VII, 8, 4, 664-6.

come the medium of sound. As usual, he sides with the common view, which in this case is the negative reply. Nevertheless, in his typical “probabilistic balancing”, Suárez is not ignorant of the evidence for the affirmative view as well. No matter how thick and nonporous walls (say) in a jail cell are, a prisoner, if attentive, can still (weakly and remotely) hear sounds coming from outside. This seems to lead to the inference that sounds, in principle, can penetrate the walls as well. However, the relevance of this example can be undermined by saying that there always are latent pores in earthy objects such as walls since there are no absolutely nonporous objects at all. Consequently, if a prisoner hears the sounds, it is because of these pores filled with air, with which the wall is “interspersed”. The real transmitter of sound is precisely this intrinsic air, not the element of earth. Suárez admits the probability of this reasoning but refuses to take it as “the slingshot argument” for principal impossibility of sound dilatation in earthy bodies. Until we have realized an experiment and *experientia* with objects composed of entirely nonporous materials, we are not allowed to draw that definitive conclusion. Consequently, the theory granting sound penetrability to those objects has its own probability. Yet, Suárez’s following final word is more probable: Earthy bodies are not the medium of sound; dense bodies cannot transmit sound because sound is a *res succesiva*. As a transient being, sound is to be conveyed through its medium *swiftly*. Accordingly, its medium must be of such a composition as will enable quick dilatation. Clearly, earthy bodies are not of such composition.<sup>33</sup>

#### WAYS OF PROPAGATION: REAL, OR INTENTIONAL, OR BOTH?

Unlike the topic of the kinds of media, the problem of ways (*modi*) of sound propagation was more controversial in the context of medieval and renaissance philosophy. Does *sonus* alter (*immutat*) the medium only *realiter*, or does it affect it only *intentionaliter*, or should we rather say that it is spread in air in both ways? Are sound and its intentional sensible species dilated in air in an instant, or in time?

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33. *DA* VII, 8, 5, 668.

First of all it must be said that, like the mainstream of scholastics, Suárez accepts the sensible species as the necessary “vehicle” securing the contact of the sound producing objects with the sense power.<sup>34</sup> The sound producing objects do not send forth only the real qualities of sound, they also emit intentional species. Suárez conceives these species as material and divisible entities, the main function of which is to (virtually) represent the real qualities. Suárez is quick to deny the following two extreme views. On the first one, sound gets spread in air only *realiter*. The sonorous objects stir air up to the organ, where, by means of a real alteration, they push along this organ and the power, in which, if attentive, the operation of hearing is elicited. According to a certain version of this view, real transmutation of the organ occurs only in the medium of air. Only intentional affection occurs in water. Since the audible species is a less perfect entity than the real quality of sound, it can better pervade a less thin medium such as water.<sup>35</sup> On the second view, sound gets spread only intentionally in air. Sound cannot be transmitted *realiter* since it exists *realiter* only in the sonorous bodies. As said, this is not Suárez’s view. So it is not difficult to see him reject this second view. Considering Suárez’s general advocacy of intentional species, it is not surprising to see him reject also the first alternative.

In his first conclusion, Suárez states that sound can be multiplied intentionally both in air and in water.<sup>36</sup> He elaborates three arguments for this upshot. 1) Sound can be heard at a great distance. However, it is difficult to envisage that we could hear it from that distance if sound travelled from there by altering the medium only naturally. It is more probable to assume that the act of hearing gets secured by means of the audible species multiplied in air. As a less perfect entity, the species is better disposed to become the vehicle for overcoming that distance. 2) In “an argument from elimination”, Suárez asserts that the tenet of purely material multiplication basically admits of a twofold exposition. According

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34. See *DA V*, 1, 282-296.

35. For Suárez’s theory of sensible species, see *DA V*, 2, 282-340; as regards its less perfect, vestigial, character see *DA VI*, 2, 6, 474-6.

36. *DA VII*, 8, 7, 670.

to the first one, sound is transmitted to ears as a numerically one entity moving as a sort of a flying arrow in air. According to the second one, the ear is immediately affected by the sound lying next to it. This sound is the last one in the series of successive parts of sound, which are multiplied in air. Neither of the interpretations is actually tenable for Suárez. Let us think of the situation of two men standing in markedly different places, who are listening to an identical sound or a piece of music. The materialist interpretation seems to be less justified in this case. In line with it, we would have to say that the numerically one part of air actually “bilocates” in different places. However, at least in the natural order, this is not possible. If the second option were plausible, it would have to be said that we hear not the original sound, produced by the sound generating bodies, but only the last sound in the series that touches a listener’s ear.<sup>37</sup> However, this is at variance with the claim about our ability to trace a sound back to its “original place”. Concluding, there is no other way how to meet the pre-theoretical intuition than to postulate the intentional multiplication of the audible species. 3) As said, sound, as the other sensibles, is the proper *per se* sensible. Like colour, it can “ex se” alter the sense power without being in physical contact with it. Thus, sound has to be multiplicative of its intentional species.

When having reached the upshot about the multiplication of the species, Suárez asks the question about its beginning. If one of the main reasons for introducing the species was audibility at a great distance, it can be claimed that the audible species do not start the multiplication until the propagation of real sound is ended. Then in fact it is only the intentional emission securing transmission of *sonus* to the farther places. Suárez denies this view. He makes clear that the intentional multiplication starts at the same time with the real dilatation.<sup>38</sup> Again, Suárez employs the argument “from the lo-

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37. This statement would amount to what is today called a proximal theory of sound. According to this theory sounds are construed as being located only at the bodily surface of the hearer. For this see R. CASATI, J. DOKIS, “Sounds”, *The Stanford Encyclopedia of Philosophy*, 4. Proximal Theories of Sound.

38. *DA* VII, 8, 8, 672.

calization of sound". If we are to be able to "localize" the place of the origin of a sound, the *intentional* multiplication, essential for the elicitation of a perceptual act, must take place *ab initio*. Since at the very outset of its existence *sonus* is the proper sensible object of hearing, so from its very start it must be multiplicative of its audible species. Last but not least, the quality of sound is a natural agent that multiplies its species "wherever" and "whenever" it is.<sup>39</sup>

It may be said that if the audible species are multiplied *ab initio*, sound will have to be perceived immediately. As the case of visual species shows, the visual species is spread in the perspicuous medium in no time.<sup>40</sup> Suárez does not assent to this analogy. The "timeless" multiplication of sound jars with our experience. At first we see the contact of two bodies, only then we perceive the sound caused by the violent percussion of the bodies. First we see a lightening, only then we hear a thunderclap. Unlike the visual species, the time lapse in the case of the emission of the audible species is a concomitant feature.<sup>41</sup>

However, considering this time lapse, the theory endorsing the multiplication of the species only from the point when the real multiplication ends seems to be better after all. This, of course, conflicts with Suárez's abovementioned assertion about the multiplication of species *ab initio*. This concept of the propagation of the species from the beginning seems to lead to the conclusion that we can hear immediately, however. This dilemma can be seen as being "rooted" already in Aristotle. On one hand, in *De sensu et sensato*, he declares that sound spreads by means of *kinésis* including the time lapse.<sup>42</sup> On the other hand, considering hearing as the paradigm of sensation in *De anima* III, 2, Aristotle speaks about simultaneity in the activities of the sounding object and the actual hearing:

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39. *DA* VII, 8, 8, 674.

40. The fact that, contrary to post-Einstein physics, light is emitted instantaneously was taken by the majority of scholastics as a matter of course. For SUÁREZ see *DA* VII, 1, 1, 552: "Lumen fit in toto hemisphaerio in unico instanti".

41. *DA* VII, 8, 8, 676.

42. ARISTOTLE, *De sensu et sensato* VI, 446a22ff, 265.

The activity of the sensible object and of the sensation is one and the same ... in saying that they are the same, I mean the actual sound and the actual hearing ... when that which has the power of hearing is exercising its power, and that which can sound is sounding, then the active hearing and the active sound occur together [hama; “at the same time”; D.H.]; we may call them respectively audition and sonance” (425b26-426a1).

How does Suárez unravel this dilemma of temporality and immediacy? How does he sail between the Scylla of instantaneous change, based on the claim of the simultaneous activities of the sonorous objects and actual perception of the power, and the Charybdis of the temporally extended multiplication, established in the propagation of the real quality of sound?

Before introducing his (how else) conciliatory conclusion, Suárez mentions three (partly resuming) preliminaries. 1) When a sound is produced, the (concomitant) action of the multiplication of the audible species is set out in the same way. 2) An important agent in the process of the multiplication of the sensible is the size of the sensible object. Obviously, as a voluminous luminary source can be seen by sight at a greater distance than a smaller object, a louder sound can be spread further than a quieter one. 3) It is also necessary to distinguish between two kinds of size, namely intensional and extensional size. A sound can be larger or smaller “intensionally” depending on the force by which it was produced. A sound can be larger or smaller “extensionally” if dilated through larger or smaller space. Both sizes are important factors to be considered in the context of reflecting on the radius of sound’s intentional and real multiplication.<sup>43</sup>

In his reply, Suárez starts from a model of dilatation already coined by Vitruvius.<sup>44</sup> This model is based on the water wave metaphor. A sound dilates in air in a manner similar to the circular waves

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43. *DA* VII, 8, 9, 676-8.

44. For Vitruvius’s employment of the (water) wave metaphor in the context of the propagation of sound see M. WITTMANN, *op. cit.*, 77.

made by the ripples on water after a stone has been thrown into it. After the first (highest) circle wave the process of multiplication begins to fade and continues till the wave motion of water gets blended with the water table. In analogy to the water waves, the dilatation of sound also circumscribes circles of different dynamic up to the ultimate (smallest) sound wave. In an explicit reply to the aforesaid dilemma, Suárez considers a notional borderline, described by the circle formed by the ultimate sound wave. Within this circle two different activities are running, namely intentional and real multiplication of sound. Given the intensional size of a sound, we can assign a borderline at a certain point within the uttermost circle, within which we can perceive sounds immediately. This “timeless” perception within this circle will meet the “littera” of the abovementioned passage from *De anima*. On the other hand, so Suárez, beyond this boundary, the multiplication of sound and the audible species will proceed only successively, i.e., with a time lapse. In this case, as Aristotle affirms in *De sensu et sensato*, the medium is affected before the sense power of hearing is. Consequently, multiplication of the species will require a noticeable time lapse.<sup>45</sup>

#### ORGAN OF HEARING

Suárez’s physiological treatment of the ear is much briefer than the other questions on sound and hearing in *DA VII*. Despite its brevity, the *DA VII*, 9, entitled *Quodnam sit organum auditus et quae ipsa potentia*, is an important treatise since it gives us a testimony to Suárez’s proficiency in matters pertaining to physiology and to the hermeneutical art exemplified by his exegesis of Aristotle as well.

With respect to the previous analyses concerning the object and the medium of hearing, Suárez comes with the predictable claim that the organ of hearing is composed of the “airy” element.<sup>46</sup> Importantly, the Jesuit distinguishes two kinds of ear, namely the external ear and the internal ear. While the function of the external

45. *DA VII*, 8, 9, 678.

46. *DA VII*, 9, 1, 680-2. For Aristotle see also his *De sensu et sensato* II, 438b20-1.

ear (in line with contemporary anatomy called the external acoustic meatus) is to protect the internal ear from damage by, say, a sudden gust of air, and thus to facilitate the reception of the species, it is the internal ear where the organ of hearing is to be placed. Contrary to Aristotle, who refers to the eardrum (*derma*) only *en passant*,<sup>47</sup> Suárez underlines the significance of this *membranula* in its role of the boundary line between the intrinsic and the extrinsic ear. What does the intrinsic ear look like? It makes up a sort of concave space where the auditory nerve leading from the brain, the root of the sensitive soul,<sup>48</sup> finds its endpoint. This nerve supplies the organ with the animal spirits (*spiritus animals*) necessary for the power's (vital) reception of the species. Although the external and the internal air filling the two ears are the same, the internal ear contains "vital air" and forms the correspondent "pars animata" or "pars spirituosa". For Suárez the proper organ of hearing is precisely this "pars spirituosa", covered by the thin membrane of eardrum stretched by the auditory ossicles.<sup>49</sup> Although no anatomical evidence for this "pars spirituosa" is available, still, according to Suárez, it is to be regarded as its organ. Generally speaking, even though in his *Commentary* Suárez often follows the medical authorities (Galen, Vesalius, Vallés), at times he seems to resist their strong naturalism. More precisely, sometimes he goes beyond it to explain the phenomena in line with the broad Aristotelian setting. Although contemporary anatomy had not detected this vital air in the internal ear, Suárez resolves its "anatomical absence" by claiming that it vanishes in death. Like in his analysis of the organ of vision,<sup>50</sup> by assigning the *sensorium* of hearing to the vital air, Suárez *ipso facto* refuses to locate it in the auditory nerve. The auditory nerve is not the organ since it is earthy rather than airy.<sup>51</sup>

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47. "When this [water enters the depth of an ear; D. H.] does occur, there is no hearing; nor again if the membrane is damaged", ARISTOTLE, *De anima* II. 8, 420a14-5.

48. For this see *DA* VII, 6, 6, 528-544.

49. *DA* VII, 9, 2, 682.

50. For his rejection of the affirmation, according to which the chiasm of the optical nerves is to be regarded as the proper organ of sight cf. *DA* VII, 5, 8, 632.

51. *DA* VII, 9, 3, 684.

As in the issue of the kinds of medium so in the question of the property of the extrinsic air, the exegesis of *De anima* II, 8 stands in the centre of Suárez's attention. In this chapter Aristotle comes with the following formulation: "The air in the ears is lodged, so as to be unmoved, in order that it may accurately perceive all differences of motion" (420a9-12). In this formulation, Aristotle suggests that the necessary property of the vital air in the intrinsic ear is its immobility. If it were in motion, *sensorium* could not perceive the oncoming sounds objectively. As the translucent (as far as colours are concerned neutral) nature of the crystalline humour in the pupil makes the pupil (objectively) receptive of the visual species, so the immobility of air makes the organ of hearing suitable for the (objective) reception of the audible species. But only a few lines below Aristotle comes with a second formulation: "... the air in the ears always moves with a special motion of its own" (420a16-7), which seems to give evidence of contrary sentences in one paragraph of Aristotle's text. How does Suárez, the philosophical conciliator, harmonize them? Of which ear does Aristotle, as a matter of fact, speak? In an untypically less clear paragraph, Suárez at first appears to refer to the *sensorium* proper, i.e., to the intrinsic ear covered by the eardrum. Nevertheless, later on he inconspicuously moves to the *external* ear, which, rather than the organ, is the (adjacent) medium. Suárez makes clear that if the operation of hearing is to function well, even this "medial air" of the external ear is to be *de se* immobile. When Aristotle speaks about the motion, so Suárez, he does not mean that this motion is a sign of its "essence" and proper functioning. Quite on the contrary, it is a manifestation of disorder. Suárez quotes from a passage from Aristotle's *De anima* following the sentence quoted above: "... sound [coming from that "special motion of its own"; D. H.] comes from an outside source, and it is not a property of the ear".<sup>52</sup> Whisper in our ears is not a natural state, based on natural continuous motion of air whether in the external or in the internal ear. It is a symptom of the intrusion of foreign air coming

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52. ARISTOTLE, *De anima* II, 8, 420a17-8.

entirely from outside. As is well-known, this always happens if we press our fingers to our ears.<sup>53</sup>

### CONCLUSION

Suárez's theory of aural perception is clearly Aristotle-oriented, especially with its emphasis on the teleological relatedness of the auditory power (organ) and its proper sensible (sound). The crucial text for Suárez is the eighth chapter "On Sound and Hearing" of Aristotle's second book of *De anima*. The Aristotelian bearing is also the reason why Suárez does not consider issues connected with other traditions such as the Pythagorean-Platonic lore focused more on the mathematical explanation of sound and analysis of musical consonances.<sup>54</sup> This also why Suárez's approach can hardly be evaluated as modern in the manner of connecting physics and mathematics, as was typical for the mechanistic philosophy of the 17<sup>th</sup> century. Suárez's approach is substantially qualitative and "elementary" in the sense of assuming the physics of elements and of qualities and the metaphysics of intentional sensible species.

Nevertheless, Suárez's attitude to Aristotle is anything but slavish. All the questions of *DA VII*, 6-9, including the unanalyzed question "De voce" (*DA VII*, 8), confirm Suárez's overall methodology of the *De anima* commentary, which amounts to a rational reconstruction of Aristotle's text, rather than its close commentary.<sup>55</sup> The segment of *DA VII* analysed above confirms this stance by the number of Suárez's "detections" of doctrinal tensions in Aristotle's texts. Beside Aristotle's unsystematic pronouncements on the topic of dilatation of sound and the audible species *in medio*, Suárez discovered doctrinal discrepancies also in the question of instantaneous *versus* successive multiplication of sound and the audible species;

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53. *DA VII*, 9, 4, 684-6.

54. For this tradition see briefly Ch. BURNETT, *Sound and its Perception in the Middle Ages*, *The Second sense* cit., 54-5.

55. For this claim cf. A. SIMMONS, *Jesuit Aristotelian Education: The De anima Commentaries*, J. W. O'MALLEY et al. (eds.), *The Jesuits: Culture, Learning and the Arts, 1540-1773* (Toronto University Press, Toronto, 1999) 522-537.

in the immutability *contra* moveability of air in the intrinsic and/or extrinsic air; in his oscillating formulations on the issue of kinds of medium of sound. In some of his conclusions, Suárez went even beyond Aristotle. I have in mind the statement that the percussion of two bodies constitutes only the necessary condition, and not the efficient cause of the production of sound. According to the originally Neoplatonic axiom the less perfect, namely motion, cannot produce the more perfect, namely the quality of sound. Suárez is also well aware of the pre-theoretical intuition we have about the localizability of sounds in the sound producing objects. Not infrequently, this localization served him as a “regulative idea”, leading him to his theory of intrinsic (airy) pores in the sonorous objects conceived as the subjects of sound. Suárez also seems to transcend Aristotle in his claim about the crucial role of the membrane of eardrum conceived as the important demarcation line between the intrinsic ear (the *sensorium* proper) and the extrinsic ear.

Besides the crucial authority of Aristotle and his Latin, Greek and Arabic commentators, an “authority” no less important for Suárez is “experience”.<sup>56</sup> “This is in contradiction with our experience” is one of Suárez’s most frequent “non sequitur” in *DA* VII, 6-9. Experience can often modify or revise the *littera* of Aristotle’s text. This can be seen in Suárez’s evaluation of the thesis about transmission of sounds by earthy bodies as of the probable view. Last but not least, I am sure that it would be interesting to compare the reservoir of Suárez’s and second scholastic experience about hearing and sound with the rich repository of the experience about the same topic in the works of Francis Bacon (1561-1626). Bacon, a contemporary of the Jesuit, whose philosophical world was separated from that of Suárez by ages, deals at length with the issues of sound and hearing in his treatise “*Historia soni et auditus*” (1608) and in the chapter “*Historia et inquisition prima de sono et auditu, et de forma soni, et latent processu soni; sive Sylva soni et auditus*”

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56. For the role of *experientia* in Jesuit natural philosophy in the 16th and in the first decades of the 17th century, see D. DES CHENE, *Life’s form. Late Aristotelian Conceptions of the Soul* (Cornell University Press, Ithaca, London, 2000) esp. 19-23.

of his *Sylva Sylvarum, or A Natural History in Ten Centuries* (1626).<sup>57</sup> In both texts Bacon presents dozens of acoustic experiments, a significant number of which is similar to the *experientiae* adduced by Aristotle and Suárez.<sup>58</sup> However, this comparison has to be left for a different occasion.<sup>59</sup>

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57. For the first treatise see F. BACON, *The Works of Francis Bacon*, vol. VII, J. SPEDDING, R. L. ELLIS, D. D. HEATH (eds.) (Hurd and Houghton, New York, 1864) 187-222; as regards the second see F. BACON, *The Works of Francis Bacon*, vol. IX, *Opera philosophica* (printed for C. and J. Rivington, London, 1826) 1-23.

58. See M. WITTMANN, *Vox atque sonus* cit., 269-270.

59. This study is a result of the research funded by the Czech Science Foundation as the project GA ČR 14-37038G “Between Renaissance and Baroque: Philosophy and Knowledge in the Czech Lands within the Wider European Context”.