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A NOTE ON PTOL. *HARM.* 102,6 DÜRING

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Ptolemy develops his own views on the connection between harmonics and astrology, that is, his particular concept of the so-called "harmony of the spheres", throughout the second half of his *Harmonics'* third book.[1] More specifically, chapter 3,9 focuses on the parallelism of the concept "consonant" when applied both to musical intervals and to astrological aspects,[2] based on the common grounds astrology and harmonics share as mathematical disciplines.[3] This is the similarity the author proposes:

> Πάλιν δὲ καθάπερ αἱ τῶν μελῶν συμφωνίαι μέχρι τῆς εἰς τέσσαρα τομῆς ἵστανται διὰ τὸ τὴν μὲν μεγίστην καὶ δὶς διὰ πασῶν τετραπλάσιον ἔχειν τὸν μείζονα τοῦ ἐλάττονος, τὴν δὲ ἐλαχίστην καὶ διὰ τεσσάρων τὸν μείζονα ποιεῖν τῷ τετάρτῳ ἑαυτοῦ μέρει ὑπερέχοντα τοῦ ἐλάττονος, τὸν αὐτὸν τρόπον καὶ τὰς ἐν τῷ ζῳδιακῷ κατανενοημένας συμφώνους καὶ δραστικὰς στάσεις ἀπαρτίζουσιν οἱ μέχρι τῶν εἰς τέσσαρα τοῦ κύκλου μερισμοί[4] (Ptol. *Harm*. 101,27–102,4).

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[1] Ptolemy's *Harmonics* is quoted by number of page and line in Düring's edition: I. Düring, *Die Harmonielehre des Klaudios Ptolemaios*, Gothenburg 1930.

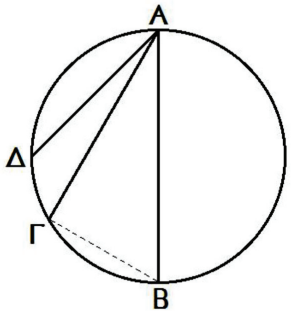
[2] On the astrological "aspects", cf. A. Bouché-Leclercq, *L'astrologie grecque*, Paris 1899, 165–79. The technical Greek term for "aspect" is σχηματισμός, but here Ptolemy is using στάσις ("position", cf. LSJ *s.v.* B.I.2. b and c), which points at the underlying position of the planets maintaining a particular aspect.

[3] Geometry, arithmetic, astrology and harmonics were called μαθήματα from the late 5th century BC onwards (cf. L. Zhmud, *The Origin of the History of Science in Classical Antiquity*, Berlin – New York 2006, 11–12); according to P. Tannery, *Recherches sur l'histoire de l'astronomie ancienne*, Paris 1893, 31, their constitution and distinction were traditionally ascribed to Pythagoras himself. Certainly, among the μαθήματα we find music (μωσικά) in Archytas (47B1 D–K), and harmonics (ἁρμονική), together with optics (ὀπτική), since at least Aristotle (*Ph.* 194a8, *Metaph.* 997b21), and of course in Ptolemy (*Harm.* 93,6–9, 95,1–2); also cf. Porph. *in Harm.* 23,13–22.

[4] "And again, just as the consonances of melodies are established by sectioning into no more

The parallelism rests then on the basis that the divisions of the string to obtain the numerical ratios of the consonances do not need to go further than sectioning into four (equal) parts (μέχρι τῆς εἰς τέσσαρα τομῆς, 101,27–28)[5] and, just the same, the astrological aspects can be displayed on a circumference by cutting it only into two, three or, at the most, four parts (οἱ μέχρι τῶν εἰς τέσσαρα τοῦ κύκλου μερισμοί, 102,3–4); and the proof of the latter assertion is as follows:

> ἐὰν γὰρ ἐκθώμεθα κύκλον τὸν ΑΒ καὶ διέλωμεν αὐτὸν ἀπὸ τοῦ αὐτοῦ σημείου, οἷον τοῦ Α, εἰς μὲν δύο ἴσα τῇ ΑΒ, εἰς δὲ τρία ἴσα τῇ ΑΓ, εἰς δὲ τέσσαρα ἴσα τῇ ΑΔ, εἰς δὲ ἓξ ἴσα τῇ ΓΒ, ἡ μὲν ΑΒ περιφέρεια ποιήσει τὴν διάμετρον στάσιν, ἡ δὲ ΑΔ τὴν τετράγωνον, ἡ δὲ ΑΓ τὴν τρίγωνον, ἡ δὲ ΓΒ τὴν ἑξάγωνον[6] (Ptol. *Harm*. 102,4–8).



The whole passage contains, however, a number of inconsistencies, namely:

1. The statement in 102,2–4, according to which there is no need to go further than sectioning *into four parts*, is in direct conflict with its proof in 102,4–8, where the circle is also divided *into six equal parts* (εἰς δὲ ἓξ ἴσα τῇ ΓΒ, 102,6).
2. Moreover, the proof itself (102,4–8) demands all the divisions to be made *from the same point* (ἀπὸ τοῦ αὐτοῦ σημείου, 102,5) *exemplified by* Α (οἷον τοῦ Α, 102,5), whence the arcs ΑΒ, ΑΓ and ΑΔ arise; but the arc ΒΓ producing the division of the circle into six equal parts (102,6) *is not made from* Α, as required.

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than four parts (since the greatest consonance, the double octave [4:1], has a greater term quadruple than the shorter one, while the smallest, the fourth [4:3], has the greater exceeding the shorter by a fourth part of itself), in the same way also the positions which have been understood as consonant and active in the Zodiac are arrived at by partitioning the circle into no more than four parts".

[5] This is true for the fourth (4:3), the fifth (3:2), the octave (2:1), the octave and a fifth (3:1) and the double octave (4:1); but it is not that clear for the octave and a fourth (8:3), which apparently needs sectioning into eight equal parts.

[6] "Indeed, if we display the circle AB, and we divide it from the same point, A for instance, into two equal parts by means of the line AB, into three by AΓ, into four by AΔ, and into six by ΓB, then the arc of circumference AB will produce the diametric position, AΔ the quadrangular, AΓ the triangular, and ΓB the hexagonal".

These first remarks were already suggested by J. Wallis;[7] but there are some more:

3. The division of the circle into six equal parts is, in fact, quite unnecessary to show the hexagonal position, since such is the position connecting points B and Γ, which had already stemmed from the divisions of the circle into two and three equal parts, respectively.
4. In addition, the arcs considered on the circle as displaying the ratios of the consonances (102,8–103,3) are again those starting from A, and neither the arc ΒΓ nor its length are taken into account.[8]
5. Finally, when the expected comparison between astrological aspects and musical consonances is set forth:

> Τάσσοιτο δ' ἂν καὶ ἐκ τῶν αὐτῶν καὶ ἡ μὲν διὰ πέντε τῶν πρώτων συμφωνιῶν κατὰ τὴν τρίγωνον στάσιν, ἡ δὲ διὰ τεσσάρων κατὰ τὴν τετράγωνον καὶ ὁ τόνος κατὰ τὸ δωδεκατημόριον. διότι καὶ ὁ μὲν κύκλος πρὸς τὸ ΑΒ ἡμικύκλιον ποιεῖ τὸν διπλάσιον λόγον, τοῦτο δὲ πρὸς τὴν ΑΓ τοῦ τριγώνου περιφέρειαν ποιεῖ τὸν ἡμιόλιον,[9] αὕτη δὲ πρὸς τὴν ΑΔ τοῦ τετραγώνου περιφέρειαν τὸν ἐπίτριτον, ὑπεροχὴ δ' αὐτῶν ἐστι καὶ κατὰ τὸν τόνον ἡ ΓΔ περιφέρεια, δωδεκατημόριον περιέχουσα τοῦ κύκλου[10] (Ptol. *Harm*. 103,5–12),

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[7] Also the *editio princeps*, J. Wallis, *Claudii Ptolemaei Harmonicorum libri tres*, Oxford 1682, has εἰς δὲ ἓξ ἴσα τῇ ΓΒ in the text at 252,20–21; but at 252 note *g* reads: *Forte tamen haec tota clausula* (εἰς δὲ ἓξ ἴσα, τῇ ΓΒ) *melius abesset,* (*adeoque quae mox sequitur* ἡ δὲ ΓΒ τὴν ἐξάγωνον,) *quippe* ΒΓ *recta, non est ab eodem* Α *puncto ducta* (...) *proceditque sectio in plures quam quatuor partes*. The same can be seen in its reprint in J. Wallis, *Operum Mathematicorum* III, Oxford 1699, at 140,21 and 140 (note *g*). Unfortunately, all the manuscripts Wallis used for the edition, as it seems according to its critical apparatus, had the *clausula* he refers to, and so he kept it.

[8] Indeed, once the length of the circumference (ABA) is assigned the value of 12 units ("for 12 is the first number to have a half, a third and a fourth part", 102,12–13; obviously, *there is no mention of its needing to have also a sixth part*, a mere consequence of its having half and third parts, exactly the same as the segment ΒΓ results from dividing the circle into two and three parts), the arcs previously described have the following lengths: ΑΒΔ = 9u ("u" stands for "units" from now on), ΑΒΓ = 8u, ΑΒ = 6u, ΑΔΓ = 4u, and ΑΔ = 3u. As a result, the ratios of the consonances are displayed in the following way: ΑΒΑ/ΑΒ = ΑΒΓ/ΑΓ = ΑΓΒ/ΑΔ = 2/1, the octave; ΑΒΑ/ΑΒΓ = ΑΒΔ/ΑΒ = ΑΒ/ΑΓ = 3/2, the fifth; ΑΒΑ/ΑΒΔ = ΑΒΓ/ΑΒ = ΑΓ/ΑΔ = 4/3, the fourth; ΑΒΑ/ΑΓ = ΑΒΔ/ΑΔ = 3/1, the octave and a fifth; ΑΒΑ/ΑΔ = 4/1, the double octave; ΑΒΓ/ΑΔ = 8/3, the octave and a fourth; and the (dissonant) tone, in its turn, is given by ΑΒΔ/ΑΒΓ = 9/8.

[9] The erratum ἡμικύκλιον (103,9) in the edition was corrected to ἡμιόλιον by Düring himself; cf. I. Düring, *Ptolemaios und Porphyrios über die Musik*, Gothenburg 1934, 18.

[10] "On the other hand, and based on the same arcs, the fifth, among the first consonances, could

We again do not find the arc ΒΓ included here, in spite of the twelfth ΓΔ, which does not start from the point A, being coupled with the dissonant interval of tone, by no means a consonance.

Thus, to sum up, the presence of the syntagma εἰς δὲ ἓξ ἴσα τῇ ΓΒ in 102,6 contradicts both the statement 102,2–4 and its proof in 102,4–8, while the arc ΓΒ herein is unnecessary, because it is redundant, and proves, in fact, to be unused to display the ratios of the consonances in 102,8–103,3, or to correspond with any one of them in 103,5–12.

Now, furthermore, the critical apparatus of Düring's edition shows that all the manuscripts of the m-stem,[11] the most reliable ones according to Düring himself,[12] lack that syntagma (εἰς δὲ ἓξ ἴσα τῇ ΓΒ, 102,6). This, in the light of the internal analysis of the passage we have just carried out, leads us to assert that the syntagma is, with no room for doubts, an interpolation and should then be secluded from the text. In my opinion, some copyist in the process of transmission of the work added it, in all likelihood, looking for symmetry in the conditional 102,4–8 between the apodosis (ἡ μὲν ΑΒ περιφέρεια ποιήσει τὴν διάμετρον στάσιν, ἡ δὲ ΑΔ τὴν τετράγωνον, ἡ δὲ ΑΓ τὴν τρίγωνον, ἡ δὲ ΓΒ τὴν ἑξάγωνον)[13] and a protasis (ἐὰν γὰρ ἐκθώμεθα κύκλον τὸν ΑΒ καὶ διέλωμεν αὐτὸν [...] εἰς μὲν δύο ἴσα τῇ ΑΒ, εἰς δὲ τρία ἴσα τῇ ΑΓ, εἰς δὲ τέσσαρα ἴσα τῇ ΑΔ) which lacked the arc ΓΒ, and the result later became the model for the text, precisely on account of that symmetry. This is perfectly possible, if it happened early in the transmission of the f-stem; indeed, that of the g-stem is closely related to it, while that of the m-stem, which does not have the aforesaid syntagma, is quite independent of the other two, according to Düring's *stemma codicum*,[14] whose draft, in its essential lines (I have kept to the main manuscripts), is as follows:

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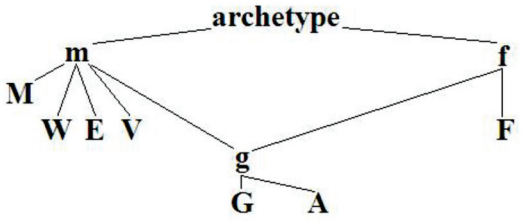
be arranged corresponding to the triangular position, the fourth to the quadrangular one and the tone to the twelfth; since the circle also makes the duple ratio with the semicircle AB, this makes the sesquialter with the arc AΓ of the triangular position, this makes the sesquitertian with the arc AΔ of the quadrangular one, and the remainder between them is as well, corresponding to the tone, the arc ΓΔ".

[11] With the single exception of V^1, and even this one only in the margin has εἰς δὲ ἓξ ἴσα τῇ ΓΒ.

[12] Cf. Düring (above n. 1), XLVII.

[13] It seems unnecessary to seclude ἡ δὲ ΓΒ τὴν ἑξάγωνον (102,7), as suggested by Wallis (above n. 7), since it is not backed by the manuscripts (at least according to Düring's critical apparatus) and, besides, points Γ and Β arise from other divisions and can perfectly show the hexagonal position, as we have already said.

[14] Cf. Düring (above n. 1), LXIX.



All in all, the syntagma in question (εἰς δὲ ἓξ ἴσα τῇ ΓΒ, 102,6) is not only inconsistent with Ptolemy's text, but not even backed by the textual transmission of it. However, the critical commentaries of Düring's edition do not mention the point, and the modern translations of the *Harmonics* all retain the syntagma.[15] In my opinion, it would be advisable to seclude it from the text in future translations and (especially) editions, so as to avoid the inconsistencies I have pointed out in the first part of this paper.

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[15] Cf. Düring (above n. 9), 126; A. Barker, *Greek Musical Writings* II, Cambridge 1989, 381; J. Solomon, *Ptolemy Harmonics. Translation and Commentary* (Mnemosyne Suppl. 203), Leiden 2000, 155; M. Raffa, *La Scienza Armonica di Claudio Tolemeo*, Messina 2002, 221; P. Redondo Reyes, *La Harmónica de Claudio Ptolomeo: edición crítica con introducción, traducción y comentario*, Murcia 2002 (doctoral thesis, available on CD), keeps it both in his edition of Ptolemy's text (at 115,21) and hence in his translation (at 251).