the world of music

ISSN 0043-8774

3/2005

Offprint

VWB – Verlag für Wissenschaft und Bildung

the world of music 47(3) - 2005: 55-79

The Western Study of Intervals in "Arabic Music," from the Eighteenth Century to the Cairo Congress

Anas Ghrab

Abstract

This article explores the history of work on music intervals in Arabic music by Westerners during the last three centuries. This analysis tries to unveil the theoretical precepts underlying their work. Moreover, although the basic interests behind this exploration differed from one researcher to the others, some of the ideas put forward were extremely influential. They served to put forth strong clichés about the music of the Arab world. Finally, through this theoretical veil, we can discern a historical evolution which is closely linked to the historical rapport between the European and Arab cultures.

Starting in the first half of the seventeenth century, we notice an interest of the Occident towards oriental music, in particular an interest in music of the Arabo-Islamic civilisation.[1] Right from the onset, this interest was in technical questions, and particularly, musical intervals. Historians, musicologists, philosophers or simply translators, were hard at work trying to explain, mainly by means of theoretical texts, the comments and notes of the first travellers on these musics. Thus, they were faced with a complexity so dense that it became a quagmire which lasted more than a century. Based on the observations and views of these musicians and researchers, this study tries to trace back this historical endeavour.

1. At the Beginning

The first Westerner interested in studying intervals from Arabic sources seems to have been the early eighteenth Frenchman Joseph Sauveur. To show the universality of his "General System of Sound Intervals", Sauveur, who is considered "the founder of acoustics," explains the "oriental music system." His source was Pétis de la Croix's translation of the *Kitāb al-Adwār* by Ṣafī al-Dīn al-Urmawī (Sauveur 1973:30-32).

Sauveur presents the division of the monochord in a different way than al-Urmawī. Instead of showing al-Urmawī's complete method, he uses his own system of eptamerids which can be described as a method of succeeding tones:[2] from the fundamental sound (S), he goes up by a succession of four major tones (*s* sounds); from its octave (R), he goes down by five major tones (*r* sounds); from the fifth (T), he goes up by two major tones (*t* sounds); and finally, from that fifth, he goes down by four majors tones (τ sounds). However, Sauveur notices that the octave in al-Urmawī's text is divided into 17 intervals, with two types of "elements:" the *comma* which is 5 eptamerids and the *baqiyya* interval (*limma*) which is 23 eptamerids. He puts forward a tempered scale with 17 equal intervals and gives its values in eptamerids (see Fig. 1):

Interval Names	Exact Ratios	Intervals in Eptamerids	Tempered System in Eptamerids
Free string	1	0 (S)	0
limma = baqiyya	256/243	23 (τ)	18
dilimma = Zalzal's second	$(256/243)^2$	46 (*r*)	35
tone	9/8	51 (*s*)	53
tone + *limma*	9/8 x 256/243	74 (τ)	71
Zalzal's third	9/8 x $(256/243)^2$	97 (*r*)	89
ditone	$(9/8)^2 = 81/64$	102 (*s*)	106
fourth	4/3	125 (τ)	125
limma + fourth	256/243 x 4/3	148 (*r*)	142
dilimma + fourth	$(256/243)^2$ x 4/3	153 (*s*)	159
fifth	3/2	176 (T)	176
limma + fifth	256/243 x 3/2	199 (*r*)	195
Zalzal's third + fourth	9/8 x $(256/243)^2$ x 4/3	204 (*s*)	212
ditone + fourth	81/64 x 4/3	227 (*t*)	230
double fourth	$(4/3)^2$	250 (*r*)	248
limma + double fourths	256/243 x $(4/3)^2$	273 (τ)	266
dilimma + double fourths	$(256/243)^2$ x $(4/3)^2$	278 (*t*)	283
octave	2/1	301 (R)	301

Fig. 1. General System of Sound Intervals according to Joseph Saveur, 1701.

A century later, Charles Fonton published the first account of his "field study" on the intervals of "oriental music." In that essay he indicates that he does not know any Turkish or Persian book describing this music in details, and that he finally studied the theory and practice of this art from the masters themselves (Neubauer 1999:34). In his approach, comparing the oriental musical system with the Western one, Fonton indicates the presence of seven basic notes in both musics,[3] as well as "half-tones," called here *nim*-s. Yet, he warns that it might be hard for the reader to believe

that "oriental music" has "voices" that do not exist in Western music. To become convinced that this is the case though, he asks the reader to have a look at the long-necked Ottoman lute, the *tambur*. The positions of the frets on this instrument show intermediate intervals between basic "tones" and "semi-tones:" for example, two frets are present between the second and the third basic notes, and also between the third and the fourth ones. Since these divisions exceed the Western half-tone, for Fonton these intervals "are more than semi-tones, they constitute third- and quarter-tones" (Neubauer 1999:46)

Contrary to Fonton, Benjamin de La Borde indicates paradoxically that he is not surprised at all that the scale of "Arabic music" differs from the European one, even suggesting that the European scale is incorrect (La Borde 1780:436). Moreover, he proposes a "new scale," what he considers to be "the only true one," and which has some similarities with the Arabic scale (see Fig. 2):[4]

Arabic scale	European scale in equal semi-tones	True scale
RASD	ut	ut
nim zergoula	...	ré *b*
zergoula	ut # & ré *b*	ut #
tik zergoula	...	...
DOUGA	ré	ré
nim kourdi	...	mi *b*
kourdi	ré # & mi *b*	ré #
SEIGA	...	mi
nim poussalef	mi	fa *b*
poussalek	...	mi #
CHARGA	fa	fa
arba	...	sol *b*
hegeas	fa # & sol *b*	fa #
tik hegeas	...	...
NAOUA	sol	sol
nim heussar	...	la *b*
heussaf	sol # & la *b*	sol #
tik heussar	...	...
HUSSEININ	la	la
nim ageam	...	si *b*
ageam	la # & si *b*	la #
AOUCH	...	si
nim neuft	si	ut *b*
neuft	...	si #
MAOUR	ut	ut

Fig. 2. The Scale of Arabic Music According to Benjamin de La Borde, 1780.

It can be noted that with his "true scale," de La Borde discovered the distinction between what is practiced by musicians and what is called today a Pythagorean division of the scale, in which chromatic half-tones differ from diatonic ones.[5] We can also see in Fig. 2 above that the "Arabic scale" has three more sounds than the scale de La Borde gives. He thus concludes that both scales cannot follow the same principles. Moreover, he remarks that the "Arabic scale" is divided into four intervals whereas the Western one is divided into two. He deduces then that Orientals "are roughly as wrong as those who follow the equal semi-tones system." What was the most astonishing for him is that, although both scales have seven basic notes, they do not always coincide: the notes *Seiga* and *Aouch* do not correspond to the European notes *mi* and *si* (or E and B). Finally, he sees an analogy with "the enharmonic system of the Greeks" and declares that he does not understand anything of this system and that he does not want to understand anything of any systems based on quarter-tones (La Borde 1780:439).[6]

The last eighteenth-century author to be introduced here is the Italian Giambatista Toderini. Helped by a European musician who knew Turkish music as well as by two Ottoman musicians, Toderini gives us a scale with non-Western notes. For Toderini however, Turkish music does not divide the octave to twelve intervals, but to 24 "quarter-tones." He also thinks that this different way of dividing the octave could be used by Italian masters to enrich their music and render it more attractive. He considers it a knowledge that could "spread a new day on the theory of that science, and clarify the dark night that surrounds ancient music" (1789:238).

A certain abbé Pizzati read Toderini's book with great delight. In a letter, of which an extract is included in Toderini's book, Pizzati finds in oriental intervals a proof of the reality of the "diatonic scale,"[7] not only theoretically, but also in practice, a matter that some people had not accepted to that date. "[They consider tones] necessary to be aligned on our division of the scale, and that there isn't any better division. There is no doubt that the Turkish diatonic scale that we see in your book is more complete than ours, because it contains more voices; Turkish [people] divide the tone into more parts than we do. Thus, their melodies are likely to be more varied and be more pleasing than ours" (Toderini 1783:239).

Possibly motivated by Pizzati's support, Toderini seems to have looked further into the analysis of intervals. For him, the Turks make also use of the seventh with the ratio 1:7 and of another with the ratio 9:15 3/4. As he indicates, this latter is more logical than the common seventh 9:16 because it is naturally present in a string's vibration.

Reading Sauveur, Fonton, de La Borde, Toderini or Pizzati, today gives us the impression that acquisition of knowledge of oriental music had become a necessity for them. Except for Fonton, the Orient is here seen as a proof of the existence of universal theories,[8] or more specifically in support of Western theories, which could not be considered any other way than a succession of equal tones and semi-tones. At that time the Orient was represented by the still-powerful Ottoman empire. It will be in

the nineteenth century that will find the first works studying the Arabic world as such.

2. History of Third-tones

If today one assigns gladly "quarter-tones" to "Arabic music"—an idea that took shape actually in the twentieth century—, it is interesting to know that there is also a history of third-tones in the nineteenth century. The nineteenth-century author who played the strongest role in initiating this view was certainly Guillaume-André Villoteau. Having joined the Egypt expedition undertaken by Napoleon, he was able to study that country's music and especially "Arabic music," to which the first chapter of his book is devoted.[9] Villoteau notes the difficulties of investigating this music, to such an extent that he considered abandoning the project (Villoteau 1826:117). Naturally, for this difficult task he had to exploit all available sources, from direct contact with musicians[10] to the study of manuscripts and consultation with specialists in oriental languages.[11] He ended up with so much information that it became problematic for him to integrate it all in his work (Villoteau 1826:2-3). Contradictory as it may seem, however, it is the weakness of his sources and the lack of references that one notices first in reading Villoteau's work. Moreover and, and although he was conscious of the complexity of the matter, he did not hesitate to seek a uniform musical theory within all these sources. He became convinced that the "Arab musical scale" was based on third-tones:

It appears, as Villoteau notes, that the Arab musical system did not maintain a constant form, and the authors he consulted did not agree on how to create it. Some authors divide the octave into tones, semi-tones and quarter-tones, and thus calculate twenty-four different tones in the musical scale; others divide the octave by tones and thirds of tones, making a musical scale of eighteen sounds; others consider half quarter-tones, which give forty-eight sounds; some others, finally, pretend that there are forty sounds. But the most generally accepted division of the octave is the octave with third-tone. Thus there is a forty sounds-concept consisting of two octaves and a third (Villoteau 1826:13-14; see Fig. 5).[12]

It is not at all clear where Villoteau had obtained this information. He probably read about the quarter-tone division from de La Borde's work, information he received from the Baron de Tott. The scale for third-tones derives from a reading of Şafī al-Dīn al-Urmawī's *Kitāb al-Adwār*, in which we read that, based on its division of the string, the tone contains three intervals and the octave consists of 17 intervals. The division into forty sounds appears to come from some manuscripts by al-Urmawī's in which he indicates the notes on the lute (see Fig. 3).[13]

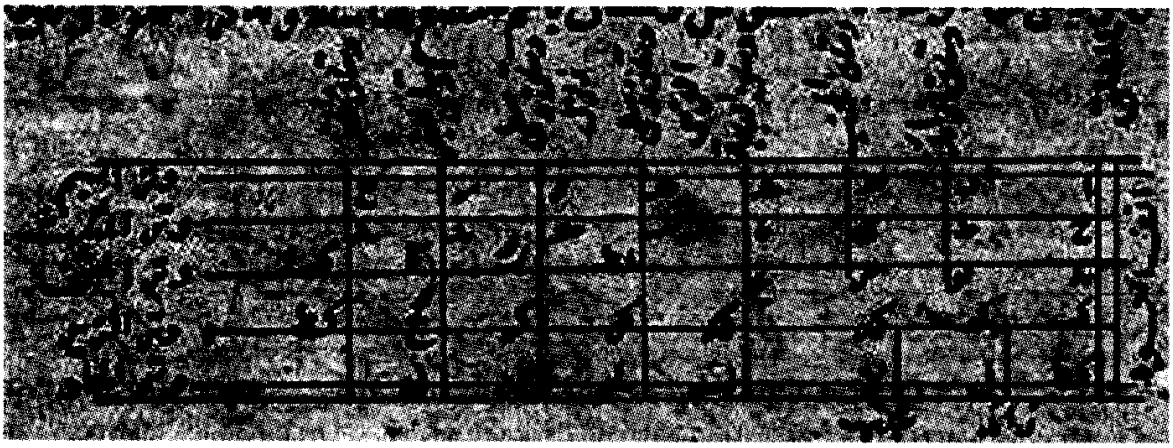

Fig. 3. Notes on the Lute as Indicated by Şafī al-Dīn al-Urmawī.

De La Borde (1780:163) reproduces this same diagram but is less precise about the positions of the frets. His indication of notes respects the original diagram by al-Urmawī (see Fig. 4).

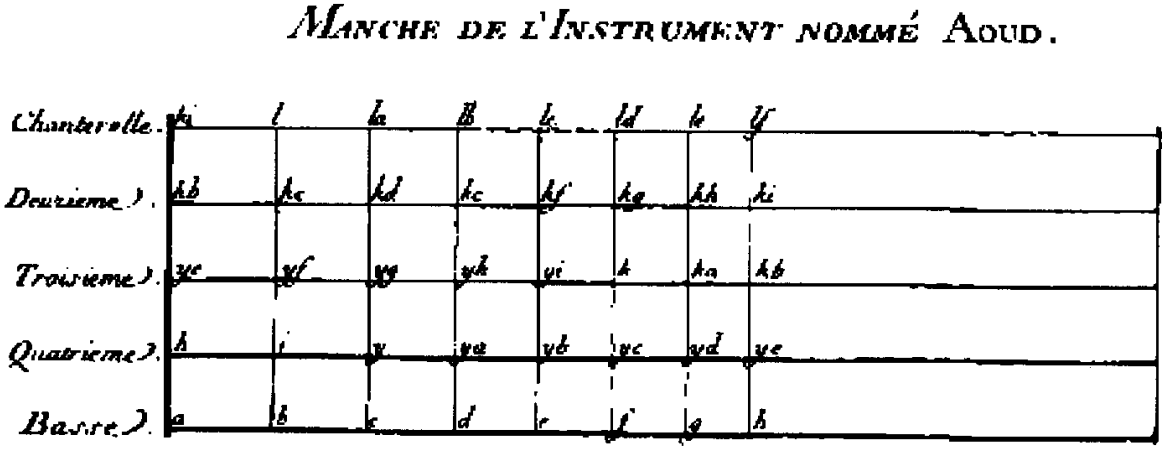

Fig. 4. De la Borde's Version of al-Urmawī' Fingering Diagram.

For his part, Villoteau (1826:45) changes considerably the diagram's information and enumerates by extension some 40 sounds, as will Kiesewetter later, which are not present in the original (see Fig. 5).

Most astounding in all of this is that Villoteau does not cite any source which uses twelve half-tones. Yet, it is a division that was presented by the anonymous author of the *Arbre couvert de fleurs dont les calices renferment les principes de l'art musical* [The Tree Covered by Flowers, or Chalices Containing the Principles of Musical Art],[14] an important presentation of Arab musical theory. Villoteau takes the liberty of modifying the scale while notating it and informs the reader that he uses a scale divided into third-tones. For him, this scale is widely accepted among Arabic authors and is the one which concurs with their instrument at tablatures (1826:15-16). He thus conceived of a scale with third-tones, in which the interval called "diatonic

Diagramme général des sons du système musical des Arabes, noté avec leurs lettres, et traduit en notes de musique européenne.

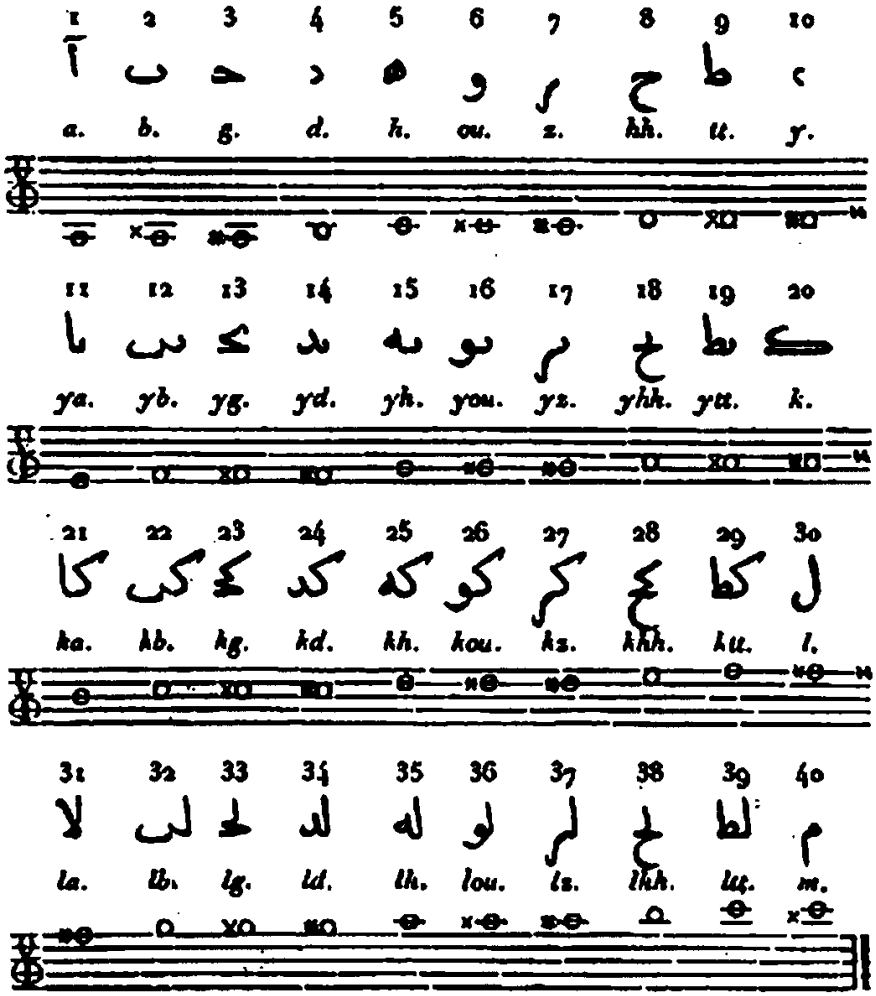

Fig. 5.Villoteaus's Diagram of Forty Arabic Notes (1826:45).

semi-tone is only a third-tone." This adaptation to an Occidental diatonic scale, of Villoteau's own invention, where tone and half-tones have an established place, will lead him to nonsense. Thus, in his study of the modal system presented by al-Urmawī, whom he did not quote, he could not obtain the same intervals between the notes *re, mi,* ^{x}*fa, sol* and *la, si,* ^{x}*do, re,* a gap that he assigns to Arabic sources (1826:65-66).

However, his way to understand intervals in general changed through his musical writing. Whereas in the beginning he relied on only very general views on intervals—that is, what any musician learns in music schools—, he had to deepen his knowledge of Western intervals. He encountered different principles in which, among other things, he learns that the *major tone* has a ratio of 8/9, and the *minor tone* has a ratio of 9/10 (1826:111), principles which he will not fully understand or

embrace. Refusing to put into question his assumption that the Arabic musical system is divided into third-tones, the former finally appears to him be simpler than the Western one:

> it ensues thus that the musical system of Arabs is necessarily more regular and more analogous than ours. Such a claim would seem to us absurdly revolting, and we would reject it with contempt before we would have been convinced of its accuracy; but today we are forced to admit that: as tiresome as this avowal would be for our self-esteem, truth obligates to recognize it, and we cannot silence it. May someone, in this century so productive in marvels, with courageous genius undertake to help to remove from the system of this form of art music, the rust of wrong principles and prejudices, a sure indication of ignorance and barbarism of the centuries during which it was developed! Could this endeavour restore the zeal of all skilful musicians, in order to finally get this art out from the narrow circle into which routine has awkwardly locked it, and where it is incessantly being outraged by bad taste, and troubled by strange whims of a capricious and fickle fashion! (1826:132-33)

Concerning the instrumental tablatures of Arab music, Villoteau indicates later on in his book that musicians "really distinguish [on their instruments] a diatonic scale; they know also that there are other degrees that go between the previous ones, and they quite frequently use them: but they cannot say really what is their nature and the intervallic distance between these degrees.... They ignore that their musical scale is divided into eighteen degrees that comprise seventeen small intervals where each one is a third of tone!" (*ibid.*:122-123). We see here that Villoteau could not keep away from the division of third-tones. Conscious of the fact that something was missing, he deepened his investigation of the theory to recognize that there exists some sort of *comma* present in Arab music as well as among that of the ancient Greeks and Westerners (*ibid.*:132-133).

Even if the erroneous information given by Villoteau misled some of his readers, it is unfair not to see in Fétis, who has been misled as well, a willingness to show the best integrity possible in his work. As part of an official mission, he could not give the reader —who did not travel to Egypt— a false image of Egyptian music. The only means he felt he had to appropriately understand what Egyptian music is was Western notation. Aiming at providing the most detailes possible, he threw himself into a conundrum for which he was not ready. It is probably for that reason that he had to explain himself when he introduced the question of the *comma*. He insisted mostly on the fact that there was a difference between what the musician played and what is indicated using traditional notation. The latter does not consider differences between intervals, something of great importance when it comes to intonation, according to some experiments he did with an Egyptian musician (1869:133) before going back to France. He was thus forced to explain more thoroughly why there was a difference between intonation and notation.

A few years later, between 1833 and 1835, the Englishman Edward William Lane, back from a trip to Egypt, wrote a book on sociology in which he discusses music, including a brief passage on intervals. He also proposes a division of the octave

into third-tones which he relates to the Egyptian musical aesthetic.[15] Being not a music specialist, he quite probably based his comments on Villoteau's work.

From the German-speaking side, the study of oriental manuscripts of music is owed to Hammer-Purgstall's work. The first person to profit from this was R. G. Kiesewetter who could thus offer the first book (1968 [1842]) presenting a history of the theoretical systems of Arabic music, and also trying to give an idea of recent practices.

Kiesewetter was impressed by the Persian "musical arithmetic" to such an extent that he saw in it a field where he could exhibit his own intellectual ingenuity. In his view, the 17-interval Arabic system was developed with the influence of Persian music, thus creating an "Arabo-Persian" one. But, for him, it is the European system with its "7 full tones and 5 half-tones" that was implemented in the Persian musical practice (1968:13-14), while theoreticians maintained Ṣafī al-Dīn's tradition in their theories. Kiesewetter (1968:15) gives us thus the following historical developments:

1. The system of 17 intervals is an Arabic system the development of which started in the ninth century.
2. At the beginning of the fourteenth century, Persian theoreticians had developed a mathematical formulation for this system.
3. At the same time a new system imported from Europe was implemented in Persia. Although it was modified over the years, its European origins are obvious, in particular, the system of "7 tones and 5 half-tones." Few Persian scholars were interested by it (*ibid.*:15).

Wishing to limit his presentation, he chose to focus on what he considered to be the "true Arabic system" without any of the Arabo-Persian variants or acoustical details (*ibid.*:16). Thus, in his chapter about the scale, he discusses only the 17 sounds of the octave, which he brings up to 40 sounds spread over two octaves and a half. Contrary to Villoteau, he links this system to the cycles of fourths, without renouncing the "third-tone" (*Drittelton*) terminology which he considers to be an extension of the Western "semi-tone" (*Halbton*). He nevertheless tries to explain how these intervals are calculated.[16] In his concluding remarks, he asserts once again that "third-tones" do not really exist, and that, in practice, only the diatonic scale corresponds to human organisation (*ibid.*:36). For this, he would be severely criticized by Fétis (1869:34-36).

After presenting the "theory of the Messel,"[17] Kiesewetter discusses again the 17 intervals. He considered them, following al-Urmawī's division of modes' transposition, as third-tones. But these are not really equal because that would contradict the "theory of the Messel," in addition to the fact that the fourth and the fifth are not pure intervals. But for Kiesewetter, the Arabs' division of the monochord seemed to have been a process of trial and error. In fact, Kiesewetter did not understand the logic of the division given by 'Abd al-Qādir ibn Ġaybī, which he presents. He was able to calculate only the octave, the fifth and the fourth. Other ratios, even if they were typically Pythagorean, were more difficult for him to grasp. He understood, though, that these intervals were neither real half-tones nor third-tones, and was able to give a

logical approximation of the tone's division: 4/9 + 4/9 + 1/9 = 1 (Kiesewetter (1968:33-34). Concerning the third-tone, Kiesewetter notes, although he does not give detailed calculations, that the division based on the "theory of the Messel" of al-Širāzī, which is derived from al-Urmawī's theory, gives a "consonant third".[18] For that reason, he will call al-Urmawī the "Zarlino of the Orient" (*ibid.*:13).

Seven years later, Eli Smith published his free translation—as he indicates himself—of a text by M. Mišāqa's text; with whom he had had personal contact (Smith 1849:174). Although there existed a terminology for use of quarter-tones, in which an arithmetical-geometric model of calculating equal quarter-tones was succinctly explained (Smith 1849:208-9 and second image), this system was largely ignored until the work of J. P. N. Land.[19] Here too, with Smith, the idea of third-tones still reigns. We can read it later on in A. W. Ambros' chapter on the music of "Muhammadian people." He states that that people had developed a "very strange" system where they replaced "our half-tones by third-tones," a system which appears to be a distortion of the Greek one (Ambros 1968:432).

The situation is not much clearer among the French authors. Written in the second half of the nineteenth century, *l'Histoire générale de la Musique* of François-Joseph Fétis, following his study of different oriental musics, takes the form of a general theory on races in their relation with music. For him, differences between aesthetics and theories of musics from various peoples reflect more biological and physiognomic differences than cultural ones (Fétis 1869:Introduction). In his approach, the musical system—which continues to be reduced to the number of intervals in the octave—is the main argument produced in support of this theory, and his conclusions include some aspects of the "Aryan race" evolutionary theory:

> In summarizing the content of this chapter, we are able to demonstrate that in high antiquity there existed a scale of twenty-four quarter-tones within the octave among the Aryans of Persia; the propagation of this scale in Minor Asia and in Greece, through ancient migrations; and finally, the similarity of this scale with Turkish music. After the conquest of Persia by the Arabs, in the seventh century of our era, the musical system of victors, based on a scale of seventeen intervals within the octave, was used in some provinces of the land, however without losing track of the ancient scale, since the Turks, after establishing their domination as early as the tenth century, had adopted this even scale of twenty-four quarter-tones. Finally, the antiquity and the identity of these systems can be shown by the Greek notation used previously to Pythagoras' time...and which has been preserved by Aristides Quintilianus. (Fétis 1869:369)

Fétis based his comments mainly on Toderini's works (Persian and Turkish music), Villoteau's (Arabic music) and the quotation by Lane, and refers to them without verifying their validity: for him, from now on, third-tones are "the basis of Arabic music." However, following the publication of the first volume of the *Histoire Générale*, Fétis had to face critics, who seemed to target not his sources or his working model, but the fact that he assigned to other peoples non-diatonic scales. It is the very existence of other systems different to the twelve semi-toned scale, and considered as "natural fact," that was not acceptable to the critics. Fétis did not doubt the re-

ality of third-tones, even though, since 1863. Francisco Salvador-Daniel had asserted that the "classification of sounds [in Arabic music] is made by tones and half-tones like us. Never could I distinguish in their music those intervals of third and quarter tones that others pretend to find in it" (Salvador-Daniel 1986:30). Fétis knew of Salvador-Daniel's work and refuted it by accusing him of getting used to Arabic music to such an extent that he could no longer distinguish its correct intervals, of having not studied it with the same methods used by Villoteau, that his comparison of Arabic modes with those of plain-chant and Greek music had been a serious hindrance, and that his seeming belief that this music must always include thirds of tones led him to a "profound error" (Fétis 1869:37-38). Fétis also indicated that some who heard Tunisian musicians at the Paris Universal Exhibition of Paris in 1867, claimed the Tunisians had no third-tones in their singing. He used a similar argument, saying that Tunisian music does not use third-tones only, meaning by this comment that the songs heard used scales without third-tones. There is a sense here that Fétis felt that his argument was lacking; he thus supports it by commenting, among other things, on the contact between Maghrebians and Europe through Spain. Could it be suggested that the half-tones of Maghrebian music are of European origin? The strangeness of the intonations are for him a proof of the use of third-tones: he comes to affirm that he had noticed, while listening to musicians from Tunis, "that they showed wrong intonations and monotonic songs," and that he did not have time to make a proper investigation "to determine the nature of their scale" (Fétis 1869:iv-v).

The belief that thirds of tones are representative of the Arabo-Persian scale remained until the beginning of the twenetieth century, as the Italian Chilesotti shows (1901-02). He presents three interpretations of third-tones, for which he proposes to give detailed calculations and ratios: one from Helmholtz, one from Kiesewetter and one from Riemann. Following his reading of Helmholtz, Chilesotti suggests that the 17-interval scale is no more than a strict cycle of fifths, but shows a "Zarlinian" form where the tone 9/8 is composed of 256/243, 135/128 and 81/80 (1901-02:595). Kiesewetter's is a strict division of the octave into equal third-tones, following the proportion of $\sqrt[17]{2}$. Riemann, for his part, proposes two Pythagorean divisions. The first amounts to the division of al-Urmawī while the second is in another form which, according to Chilesotti, Riemann preferred.[20] For Chilesotti, Riemann's is the best division for the reason that it would be the "most logical and simplest one (*ibid.*: 598)." However, Riemann (1929:36) considered both divisions equivalent even if he did not give detailed calculations. Further, he points out that one can find in this division a number of pure thirds.

> Harmonies [of Arabo-Persian music] would thus be more pure than in the tempered system of 12 half-tones. Since the theory of the Messel defines the third as a consonance of 4/5, this is no accident. With such results, we think that the 12 *maqamat* made by theoreticians are abstract theorems of melodies. Practical music is not constructed from scales but from melodies. But already in the fourteenth century, the Western system had become widely known in practical music while theoreticians maintained their interest in the theory of the Messel. (Riemann 1929:36)

3. The Diatonic Foundation of the Arabic System

At a certain point, the re-affirmation of the primordial importance of diatonism begins therefore to be felt. As Fétis and Ambros, Félix Clément includes "Arabic music" in a general history of music, under a chapter titled: "Music of the Arabs" (1885). His study of intervals is much less authoritarian than that of his predecessors, but to the prejudice of clarity. It can be suggested that Clément tried to rally diatonism and "the appreciation of closed intervals," as well as reducing the differences found by Fétis between Oriental and Western music. He based his argumentation on musical practice as such and on musical perception by listeners. Indeed, he asserts that Arab music is diatonic because it contains tones and half-tones. He thinks that it is the character of that people and their approach to music that leads musicians to be attracted by small intervals. Besides, instruments with fixed pitches are lacking in this culture, contrarily to the Western one. But a musician would utilise "third- and quarter-tones while linking them to tonality with such an art that one does not perceive [them] and does not think about a theory of the scale composed of seventeen thirds or twenty-four quarter-tones" (Clément 1885:61).

On the other hand, "in choirs [of Western music], mostly in those of male voices, a scrupulous ear notices...that a half-tone is often lower than it should be, and that singers move down of two thirds of a tone rather than a half-tone" (*ibid.*:61). He wonders also:

> Which well organized musician has not been stricken by the difference of intonation that exists while playing a Haydn or Mozart trio by a violin, viola and a cello, and a Mendelssohn trio, for example, by a violin, a cello and a piano, in which string instruments are frequently in discord with the equal temperament of the piano. The imagination of the listener, and moreover his comprehension of the musical discourse, replace what he does not really hear. He thinks that he had heard the correct sound because he grasped the composer's intention. (*ibid.*:61)

These two comments by Clément somehow show that, after all, he believed that there is no real difference in the practice of intervals in both musics. "Their musical practice is empirical and based on feelings and musical expression." Besides, Western musical practice of intervals is more complex than it seems to be. Without giving a real conclusion, he only asserted the diatonic foundation of "Arabic music" supporting this with Salvador-Daniel's statements. Furthermore, he underlined the fact that the treatises used by Villoteau and Kiesewetter contradict themselves and cannot thus be used as references.

We can distinguish similar conclusions in J. Tiersot's writing: one should observe practice and this shows that those intervals are not specific to Orient. "What is true is that the *foundation of music* is and always was, with all peoples, the diatonic scale. But this scale can acquire chromatic alterations sharp and flat. Let these alterations be slightly more or less wide than half-tones, and we get the third-tones of the Arabs." (Tiersot 1905:60)

Diatonism is also confirmed in practice by the Baron Carra de Vaux in his work on the second book of al-Urmawī, *al-Risāla al-Šarafiyya*, which was at that period still unknown, and which presents a context completely different from the 17 intervals in the octave. This author gives no opinion on third-tones, which were developed from the first book of al-Urmawī or from derived works. Therefore, and in reference to the large number of intervals broached in this second work, he makes only this remark:

> We have shown that the series of eight sounds in the octave dominated this art, as the scale in ours. The number of sounds, very large in theory, was much reduced in practice, in which subsists only half-tones and sharps. (de Vaux 1891:354)

4. The Genesis of Quarter-Tones

At the same time of the publication of the *Histoire de la musique* by Félix Clément, J. P. N. Land gives us one of the main nineteenth-century works that delved deeply into intervals from Arabic sources. The idea of diatonism in Arabic music is also very present in his study (Land 1884-85:99), but his real interest resided in the wide historic reading of interval practices, started previously by Kiesewetter. Land values the text of al-Fārābi,[21] neglected by his predecessors, presents the *wūstā of Zalzal* from which puts forward the expression *neutral third* (*ibid.*:98), and refers to Mišāqa's treatise, translated some years earlier by Eli Smith (1849). Because these authors all make mention of quarter-tones, Land brings about a transition from the history of third-tones to one of quarter-tones in "Arabic music."[22] But he considers quarter-tones as a part of a multitude of practices presented by authors from different periods, and not as the "Arabic musical scale." For him we have here different variants of a diatonic foundation.

His work had an immediate impact. Starting in 1884, Alexander J. Ellis, an acoustician who provided mathematical calculations and helped Land to interpret his work, insisted that his aim was to give an auditory idea of "non-harmonic scales" in current musical practices, among others, of the musics of "Arabia and Syria." He mentions of a "scale of Zalzal" which contains a third and a sixth lower by about a quarter of a tone from a diatonic third of 408 cents.[23] This scale would have been tempered not long ago, as was read in Mišāqā's treatise.[24] Ellis goes further and claims that the crusades, which took place after Zalzal's death, brought the Syrian *bagpipe* to England, which later became the national instrument of Scotland's Highlands. In analyzing the intervals of the scale produce by this instrument, he discovered in its tempered form the intervals of the "Damascanian form of Zalzal's scale" (Ellis 1885:371-72)!

Dom Parisot also discusses the "Arabic scale" from a historical perspective. For him, the origin of music and its beginnings were similar among all peoples, but afterward, each "race" adapted it to its own requisites. Although Parisot gives some historical and theoretical data—not always with proper rigour—he valued more a dis-

tinction between the theory and practice of intervals: the complex calculations of Arab theoreticians existed only in theory (Parisot 1899:281), and arbitrariness prevails among theoreticians for intervals other than the "primitive" ones: octave, fifth, and fourth *(ibid.*:82). Concerning the scale as it pertains to practice, he first presents a scale composed of four half-tones and five steps, *ut, ut#, ré, ré#, mi, fa*, and argues that it has a greater number of steps than the Greek tetrachord the current scale (*ibid.*:82). He came to the conclusion that "the Arabic scale" has ten intervals and eleven steps.[25] This may be related to his interest in showing, after presenting an evolution of the scale using Land's and De Vaux's work, some common principles in the creation of Gregorian modes (*ibid.*:87). He did not, however, follow up on this idea. After the conference of 1898, he presented Mišāqa's scale of twenty-four tempered quarter-tones, whose treatise seemed to have been "the practical handbook of musicians in Syria", even if its scale is "defective in its principle and shows lack of clarity" (*ibid.*:89).

In parallel to Parisot, Dechevrens' view of the "natural" scale is typical of a great number of musicologists of the end of the nineteenth century, a view which has been widely maintained later on:

> I showed, in my second study (chap. II), how the first theoreticians of Gregorian music went about to put in place the *harmonic canon*, i.e. the true measure of all musical intervals, and we saw from the first study, that this method is a most scientific one, as it is based on a natural fact, today well-known in acoustics, that is, the phenomenon of harmonic resonance.
>
> That is the scale which we have been using for a long time; the Occidental Arabs maintained it as well, not for its scientific principles which they ignored, but because it is the only scale which conforms to nature and also because, there, nature has neither been destroyed, nor tainted by a wrong musical education. Arabs of the Orient, on the contrary, and modern Greeks, between the tenth and the fourteenth centuries, abandoned the traditions of their fathers and pounced on innovations which are as unscientific as to be disastrous to the art of music itself. What else did they find in it, except ruin and decline? (Dechevrens 1898, Annexe I:11-12)

Dechevrens' talk may be misleading. His description of harmonic resonance as the source of his scale could lead us to think that he is describing the "Zarlinian" scale, also called the "physicians' scale." This scale uses more consonant intervals than the "Pythagorian" scale and provides the pure third (5/4). But upon close examination of the *Études*, he is talking about the "Pythagorian" scale deriving from the cycle of fifths.

Following the reading of Dechevrens', Parisot suggested that the ancient Arabic scale was purely diatonic and that, through foreign influences coming from Persia and Greece, for example, it was later altered. Dechevrens contended that the Arabs did not stop or slow down the corruption from various origins, such as Greek and Turkish, of their music. However, he uses Salvador-Daniel's work to distinguish African Arab music, where "primitive" traditions were maintained, while musical decline continued among the Arabs of Syria, who had wrongly imported Greek theory.

He concludes that number of degrees and intervals became greater in Orient, and this "fanciful multiplication" of intervals possibly produced confusion among theoreticians of "Arabic music." In this context, the tempered scale of Mišāqa appeared to Dechevrens as a simplification of a chaos. Even if it is a "strange" one, it gives a perfect regularity in which "Arabic music" uses only three "simple" intervals: the "great tone" composed of four *diesis*,[26] corresponding to a major tone, the "small interval" composed of two *diesis* the value of which is exactly a tempered half-tone, and the "mean interval" of three *diesis* which corresponds approximately to the minor tone.

The writer who left the most persuasive mark at the beginning of the twentieth century was M. Collangettes, professor of physics in Beirut. Similarly to J. P. N. Land, he presented a fairly lengthy work based on theories from Arabic authors who distinguish mathematical processes from practice. Moreover, he refutes the third-tone scale proposed by Villoteau and Kiesewetter (Collangettes 1904:409). For the "modern scale," Collangettes asserts that "all oriental Arabs agree nowadays with a scale of twenty-five notes in the octave. The numerous testimonials written and oral that I have gathered are concordant on this point" (*ibid.*:411). He leans towards Mišāqa's work—the scale of which was, according to Mahmūd Kahhāl, universally accepted in Damascus—and relies on the *Safinat al-Mulk* of Šihāb al-Dīn and on the Egyptian author 'Oṭmān ibn Muhammad al-Ğundi. He also emphasized that that scale is similar to the one used by musicians from Baghdad. Collangettes admits however that those musicians agree only on the overall form of the scale, asserting that, besides the tone and the half-tone, there exists a interval smaller than a half-tone called "quarter" (*rub'*), but its exact value is to be calculated.

After having analyzed Mišāqa's text, Collangettes concludes that it is not possible to establish a theory of the "modern scale" solely from Mišāqa's text, "all the more so that in his different [arithmetic and geometric] methods, his own calculations do not concord." Finally, he decides to measure intervals by experience from miscellaneous instruments, with various musicians and with a sonogram:

> There were divergences between the results obtained, which one had to expect, but they were ordinarily of little importance, and there were as well absolute concordances. Our research pertained mostly to the intervals: *yeka-'iraq, rast-sika, nawa-aouj,* and our results agreed with the *wosta* of Zalzal: as for the flat that precede the notes *'iraq, sika, aouj,* our measures provide us with the certainty that they correspond to the diatonic *wosta*. Entire tones are major tones, other "quarters" are really quarter-tones, which seem to have been generated through a desire to get some regularity in the division of the octave. But it is rarely put to use. The modern scale is not a tempered scale which follows a progression of $^{24}\sqrt{2}$; it is an old thirteenth-century scale with some added intervals. (Collangettes 1904:414)

5. The Berlin School

A new development marked the beginning of the twentieth century: the analysis of practice in order to resolve the question of the intervals of music. It was in Germany,

in parallel to Collangettes' work with the sonogram, that a totally new approach in the study of intervals appeared. The invention of the phonograph by the American Edison in 1877 allowed the "Berlin school" (Christensen 1991) to use live recordings, which included Arabic music. Following Ellis, Hornbostel and Abraham (1904:204) used the *cent* as a new reference and as a mean of comparison. The work of Hornbostel (1906) on some Tunisian melodies remains unique in its method since it analyses the pitches within these melodies without trying to integrate them into a preconceived scale. Hence, twenty melodies lead him to twenty scales, but, he indicates that, even though this large number of different scales might give an impression of hazardous intonation, some internal concordances are present, and one needs to analyze a larger number of melodies to uncover clearly these scales. He supposed, however, that what seems to be "hazardous intonation" could be related to some psychological phenomena as well as to the influence of melodic movement. But these variations of pitch are not specific to this music, and could be found in any music having a broadened feeling of tonality, including Western music, which lacks such types of studies (1906:32-33). Hornbostel concluded that the state of our current knowledge does not allow us to ascertain a representative Arabic scale. However, this did not prevent him from presenting a table which summarized his results, with 24 tempered quarter-tones as reference. All values between 275 and 325 cents were considered minor thirds, and values between 325 and 375 "neutral thirds." Of course, his 24 interval scale was a reference already known (1906:35).

6. Intervals of "Arabic Music" in Max Weber's Sociology of Music

It is not at all unexpected that, in comparing different musics, a sociology of music will be put forward in order to explain the peculiarities of Western music in comparison to other musics. In considering the social conditions which led him to conclude that only Western music had developed a "harmonic" music, Max Weber showed an interest in non-European musics and in particular "Arabic music." His main focus centred on the question of the rational and the irrational, a line of thought which could guide the development of a harmonic system or be its impediment. For him, "primitive musics" have interval modulations that are based on melodic expression; this is made possible by the use of small *irrational* variations. These influence the "music of high cultures", among them Arabian music, which has made "progress in precept" by ignoring the fact "that some neighbour sounds which are irrational between themselves can be used at the same time" (1998:82). "The position of the fifth, one of the fundamental harmonic intervals, was not reliable among Arabs" (*ibid.*:128), the fourth, on which the *'ūd* tuning is based, was "rational," but most of all, it was the third which appeared to be "irrational."[22] Weber does not limit himself to the third, but talks about an entire "irrational system" (*ibid.*:65). He concludes that the evolution of the Arabic system supported the irrational third. Based on Weber's conclusions, we would have chronologically: [1] a rational Pythagorean system; [2]

with the Persian influence and the reform of Zalzal, irrational intervals find themselves alongside with diatonic intervals which had been enriched between the tenth and the thirteenth centuries; [3] in the thirteenth century all intervals were brought back to a system based on the cycle of fifths;[28] [4] and finally, the "modern Arabo-Syrian manner of calculation," in reference to Mišāqa.

What Weber considers here is only the non-tempered aspect of Mišāqa's discussion, which is what Colangettes underlined (1904:417). Mišāqa distinguished 24 quarter-tones, but in reality he divided "each of both joined fourth into a whole tone (8/9) that he considers equal to 4 'quarter-tones,' and two different intervals of almost 'three quarter of a tone'—11/12 and 81/88—that he considers as being both equal to 3 'quarter-tones'" (Weber 1998:71). Mišāqa's scale would thus contain the seven intervals the most used in practice, including, among others, "Zalzal's ancient third." It was important for Weber's theory to maintain that these "quarters" or "thirds" of tone were not really "equal" (*ibid.*:72). Land's criticisms of Villoteau's and Kiesewetter's "third-tones" were of great help. In this sense, and even from Mišāqa's theory, we get neither equal intervals between notes nor a "temperament," something essential for a true harmonic system. The tendency to "equality of distances" between intervals was to be found in all cultures, including the Arabic, except that there this scale "was deeply confused because of these irrational thirds" (*ibid.*:71-74).

Thus, the "irrational thirds"—also found on instruments described by al-Fārābī—comprised intervals which are made "in a totally arbitrary and mechanical way," and found their way into Mišāqa's theory: "such musical arbitrariness deeply altered our perception of music and took us away from an understanding of harmonic relations" (*ibid.*:128).

For Weber, this is not specific to the Arabs. All of Western music seems to have this "irrational third" which in all likelihood comes from the *bagpipe*. The "particular ethos of this irrationality" had been an important source for musical reformers, enticing them to produce new irrational thirds. Moreover, "the invasion of the Middle Eastern world by the musical system of the Arabs definitely stopped any evolution toward harmony or even toward a strict diatonism" (*ibid.*:125).

7. "Micro-intervals," a New Market?

Piano manufacturers also showed an interest fairly early in dividing the octave beyond twelve half-tones. In 1912-13 a piano was created with the purpose of playing al-Urmawī's scale; it was a collaboration between Nagib Nahhās and the society Rud IBACH Sohn (Berlin) (Collective 1992:347-48). A document of 1928 indicates that Nahhās also collaborated with the manufacturer Gaveau in Paris and with the keyboard maker Herburger (*ibid.*:347-48). The piano that Nahhās presented during the Congress of Cairo of 1932 was a result of these last attempts, but was finally made by

the manufacturer Föster. It comprised 3 levels, the first for quarters of tone, the second for half-tones and the third for third-tones.

Georges Sammān, backed by the Egyptian minister of foreign affairs, was also in contact with a German company in order to commercialize his piano, named OLO-A, made in 1922. An OLO-B, made by the same company was also built. Concerning it, an agreement, involving the Gramophone Company, was signed in 1931 between Sammān and Mansūr 'Awwād, the later co-director of the Oriental Music School. Among other attempts, the French manufacturer Pleyel collaborated with Emile 'Ariyān, and Föster with the composer Aloïs Haba (*ibid.*:353).

8. Toward a Settling of the Scale

Research on intervals continued with the intensification of contacts between theorists and practicians of Middle-Eastern music. J. Rouanet (1922:2749-54) referred back to Collangettes, adding the divisions of other modern authors, among them Muhmmad Kāmil al-Khula'I,[29] Idrīs Rāğib Bey, Muhammad Dhaker Bey[30] and, concerning transposition which began to be updated in the Arab world, Nakhla Ilyās Matrğī. For Rouanet (*ibid.*:2753) "the scale of Arabian musicians gets along very well with all the meticulousness and the calculations, and this insistent fact allows us to agree even with Mišāqa and his translators in giving us an exact notion of the modern Arabic scale which is reduced to its simplest expression." Finally, Rouanet confirms that the scale given by Collangettes conformed "to traditions as well as current practice" (*ibid.*:2753).

At the time of the Congress of Cairo, the Western viewpoint on the question of intervals is best presented by the Baron d'Erlanger.[31] One can see that the scale given by Collangettes remained marginal; further research needed to be pursued. Despite the progress of the knowledge acquired from Arabic writings, the trace of some doctrines strongly remain. Indeed, right from the first pages d'Erlanger (1930-59,V:3) writes that "the diatonic scale, Pythagorean or the one from physicians, the scale built out of consonant sequences of fourths, fifths and octaves, is the only natural scale, the only one to be immediately given by the Nature, according to an opinion generally admitted by musicologists."[32] Having certainly noticed that the fret positions of the *'ūd*, as found in al-Fārābī's *tunbūr* of Khurasān (Erlanger 1938:242ff.) and in Şafī al-Dīn's *Kitāb al-Adwār* (Erlanger 1938ff.), give this scale. Erlanger had to consider that the Arabic modal system contains all possible scales that could be produced by this "natural scale." Besides, this system had some notes that are considered "artificial." For d'Erlanger, even if "we admit with the acousticians that the human voice by itself would produce only sounds which belong the so-called 'natural' scale," musical instruments were used here to get the voice accustomed to artificial sounds, preventing it from drawing back to sounds of Nature. Musical instruments allow for all imaginable ways of dividing the scale (*ibid.*:3-4). One could deduce this from Collangettes', and as indicated in the *La Musique Arabe* (*ibid.*:4-5), the prob-

lem was no longer to better understand the intonation and intervals used by Arabs, but had become a problem of the fixation of the "Arabic musical scale."

9. Synthesis and Conclusion

With this investigation of the Western literature on the study of intervals in Arabic music, over a period of more than two centuries, I hope to have clarified the historic and conceptual grounds which dominated those studies. We see first of all a split between acousticians, i.e. Saveur, Helmholtz, Hornbostel, and musicologists and historians such as Villoteau, Fétis and d'Erlanger. While the first mastered the physical and mathematics of sound and could correctly relate the Western scale to the data they gathered about Oriental systems, the latter dealt only with the traditional reference of 12 semi-tones in the octave, without taking hold of its conventions, fluctuations, history and practice. When a musicologist was more thorough in his study of the scale (e.g., Dechevrens), the "Pythagorian" scale was taken as the reference because it was considered the natural scale of comparison.

Usual methodologies in the study of intervals were not adapted to such an enterprise. That is, knowledge about the history of "temperaments" of Western music and understanding the problem of octave incommensurability were necessary for such an investigation. Charles Fonton, for example, noticed the large number of frets on the Turkish *ţambūr*, but he had no knowledge of Niccolo Vicentino's *Archicembalo.* Seen from this angle, one could wonder if the aim of al-Urmawī, who presented a division of 17 intervals in the octave, differs from that of Salinas, in 1577, who proposed a division of 25 intervals in the octave. Both Fonton and Salinas wanted to find the most correct intervals, i.e. the correct fifth (3/2), and the correct third (5/4). They both went beyond the typical Western diatonism.

Moreover, these authors read limited sources without taking into consideration the cultural complexity of the Oriental world. The overall attitude was to find some kind of universal model while ignoring what could not be integrated within it. Although d'Erlanger knew about them, the work on "Arabic music" by Dechevrens, based on that by Salvador-Daniel and Parisot, with the interpretation of occidental "African Arabic Music," and oriental "Syrian Arabic Music," did not have much impact, even if it helped research on Gregorian music and ancient Greek music.

If the study of texts had progressed by referring to and studying translations of known manuscripts, the view of pitch organization did not change among musicologists, the five tone and two semitone divisions of the octave remained dominating. Analysis of practice, intuitive in its beginning, but systematized with the "Berlin school" did not acquire followers. Yet, this was the only type of research which could give a more thorough explanation of the whole subject matter. On the other hand, work from secondary sources imposed their views on intervals and on their history, and ended by classifying as "Oriental music" the music coming from the Islamic

world, mixing up the ethnic Arabs with the wider range of inhabitants of areas where Arabic is officially spoken.

Paying a closer look at the general evolution of these investigations, one notices in the Western attitude, even in a schematic manner and with possible overlaps, a progression of three steps: first, the interest in Oriental music reflected an interest in the Other, an Other to be traveled toward, observed und then studied. In that situation what took precedence were comparative approaches, and some of the collected information fed universal theories, which must be underlined, even if they did not constitute the central point of a study. Once researchers had an idea of the music of the Other, the second step was to return back onto the Self. The look back at the Self allowed some authors, while elaborating *General Histories* and studying Western particularities, to refer back to Western music not only in its internal history but also toward its ancient and foreign precedents.

Finally, with the third step we observe an involvement with the Other. The Occident having conceived of an "Arabic music," needed to fix to a unique scale in order to define that music, and one was thus imposed. However, even if we do not detail the nature of this involvement, we have to evoke the fact that, from the other side, the emerging Arabic nationalism found evidently its interest in an "Arabic music" concept, which naturally needed a unified "Arabic musical scale." In a colonial universe, in a period where actors were numerous, it became a complex venture to determine everyone's role. But what cannot be concealed is that, even before the Cairo Congress, the division of the scale into twenty-four quarter-tones had been adopted. Egyptian institutions were in contact not only with musicological researchers, but also with piano makers. In some ways, the Congress was organized only to officialize the scale. European scholars were invited or involved not only as academic authorities, but mainly as witnesses of that change. Once that musical system of the Arabic world was validated and officialized, everyone was ready to approach a new market with new commercial products. If some years earlier researchers were in disagreement on the question of the scale, political and commercial powers had now settled the question, even if at that time a commercialisation of pianos with twenty-four quarter-tones did not occur. Only with the YAMAHA PSR-62 in 1986 an "Oriental" key was added to the equal-tempered twelve semitones. When this key is pushed, the third, i.e. the interval C-E will be lowered by a quarter of a tempered tone. Thus, the exact quarter-tone was finally realized.

Acknowledgement

I would like to thank Christian Poché for his remarks during the translation of this article.

Notes

1 For a general view see Neubauer 1998 and Poché 1989.

2 In this method, the octave is divided into 301 equal units, each one being an eptamerid. The "major tone" (9/8) is composed of 51 eptamerids.

3 The names of the seven basic main tones are: *ïeguiah, achiran, arak, rast, duguiah, seguiah* and *tchareguiah* (Neubauer 1999:45).

4 Benjamin de La Borde indicated that this scale was transmitted to him by the Baron of Tott, a diplomat and French general in Turkey. I reproduce here de La Borde's transliteration.

5 The division deriving from the cycle of fifths; a scale given only by pure fifths (ratio 3/2) and pure fourths (4/3). It gives the tone of ratio 9/8 and a non-consonant third (ratio 81/64). The division of al-Urmawī indicated above is an extension of the Pythagorean scale.

6 Later on, many authors will regularly try to find a link between oriental and ancient Greeks music, "quarter-tones" being the common principle in their investigation.

7 Referring here to the Pythagorean scale. This Pizzati is possibly Giuseppe Pizzati, author of *La scienza de' suoni e dell'armonia diretta specialmente a render ragione de' fenomeni ed a conoscer la natura e le leggi della medesima*, Venice, 1782.

8 It was in order to write his *Harmonie Universelle* that, during the seventeenth century, Marin Mersenne looked for Oriental music manuscripts.

9 Volume XIV of the *Description de l'Égypte*. The second part of the volume XIII is dedicated to musical instruments. A section of the volume VI by Villoteau also discusses musical instruments, but from sculptures present on ancient monuments.

10 See chapter II, "De la pratique de la musique parmi les Égyptiens modernes."

11 Nevertheless, he still misreads some translated texts. He inverses, for example, the meaning of a sentence in the note 1 of page 13. The author he cites, al-Mārdini, says that names of modes he gives are different from those of the Persians. Villoteau translated that as "according to the Persian system."

12 The diagram appears on Villoteau 1826:45.

13 This Figure is derived from the manuscript shown on dewey.library.upenn.edu/sceti/ljs/PageLevel/index.cfm?ManID=ljs235&Page=14; see also, d'Erlanger 2000:III, 372.

14 A translation of the seventeenth century text *al-Shajara dāt al-Akmām al-Hāwiya li Usūl al-Anġām* was edited by Ġattās 'Abd al-Malik Khašaba and Isis Fathallah, al-Hay'a al-Miṣriyya li al-Kitāb, Cairo, 1983.

15 "The most remarkable peculiarity in the Arab system of music is the division of tones into thirds. Hence I have heard Egyptian musicians urge against the European systems of music that they are deficient in the number of sounds. These small and delicate gradations of sound give a peculiar softness to the performances of the Arab musicians, which are generally of a plaintive character. But they are difficult to discriminate with exactness, and are therefore seldom observed in the vocal and instrumental music of those who have note made a regular study of the art." (Lane, 1936:352)

16 See the chapter "Von den Verhältnissen der Töne, und von der Art und Weise dieselben zu berechnen. Von der Consonanz und Dissonanz."

17 The term "das Messel" is undoubtedly a latinisation of the Arabic word "al-mithl" (*M-TH-L* becomes *M-S-L* and *al-* becomes *das*. Kiesewetter used the word first on p. 25, and it indicates "the same," "the similar," or "the similar to itself". "Al-mithl" is considered equivalent to 1/1, i.e. , the total length of the string to which another proportion on the string is then added . For example, "al-mithl wa al-thuluth" ("the same and the third") is the intervallic proportion between the total string (1/1) and its third (1/3), which is equivalent to 3/3 + 1/3= 2/3, i.e. the proportion of the pure fifth.

18 But for him, it was a knowledge belonging to Persians which was ignored by Arabs.

19 Mišāqa's system was quoted by Helmhotz 1983:434-35.

20 We do not find though such assertion in Riemann's text. The order in question is: *do*, *do#*, *ré*^{b}, *ré*, etc. instead of *do*, *ré*^{b}, *mi*^{bb}, *ré*, following the Pythagorean division.

21 He gives a translation of some sections about musical instruments. Those sections constitute mostly his history of the Arabic scale.

22 It must be said here that the idea of quarter-tones was not new. Turkish and Greek were considered as representative of quarter-tone musics. See, for example, Bourgault-Ducourday 1877.

23 Given intervals in cents the scale is *C* 204 *D* 151 *qE* 143 *F* 204 *G* 151 *qA* 143 *Bb* 204 *C*.

24 *C* 200 *D* 150 *qE* 150 *F* 200 *G* 150 *qA* 150 *Bb* 200 *C*.

25 It seems that he added here a second tetrachord without completing the octave.

26 I translate here the French term "dièse" (sharp, in English) into its Greek etymological *diesis*.

27 Land (1884-85:98) had used the expression "irrational third."

28 According to Weber (1998:71) the latter seems not to qualify as "rational," as one would expect.

29 Author of *Kitāb al-Mūsiqā al-Šarqī*, 1906.

30 This musician apparently wrote a book entitled *Hay'at al Insān fī Tudīt al Alhān*.

31 It is difficult to know how much one should include here Baron's collaborators and to which exact period the work dates from. The volumes of *La Musique Arabe* were published after the death of d'Erlanger and the four first volumes based on Mannūbī al-Snūsī. Although volumes V and VI were published only in 1949 and 1959, in all likelihood, they were written before the Congress (see Christian Poché's preface to the reprint of *La Musique Arabe,* 2001, p. 22). Despite this, the chapter from which the quotations in this article were extracted were written after the Congress.

32 Notice here d'Erlanger's lacunas, possibly coming from Dechevrens: the "Pythagorean scale" and the "scale of physicians" are considered synonymous, while today, and probably also in that period among acousticians, the "scale of physicians" was based on different ratios.

References

Ambros, August Wilhelm

1968 *Geschichte der Musik I: Die Musik des griechischen Altertums und des Orients*, rev. B. Sokolowsky. Hildesheim: Georg Olms [1887, first printed 1862].

Bourgault-Ducourday, L. A.
1877 *Études sur la musique ecclésiastique grecque, mission musicale en Grèce et en Orient, janvier-mai 1875*. Paris: Hachette.

Chilesotti, Oscar
1901-2 "Le scale arabo-persiana e indù." *Sammelbände der International Musik-Gesellschaft* 3:595-98.

Christensen, Dieter
1991 "Erich M. von Hornbostel, Carl Stumpf, and the Institutionalization of Comparative Musicology, " in Bruno Nettl and Philip V. Bohlman, eds., *Comparative Musicology and Anthropology of Music: Essays on the History of Ethnomusicology*, 201-09. Chicago: University of Chicago Press.

Clément, Félix
1885 "La musique chez les Arabes," in *Histoire de la musique, depuis les temps anciens jusqu'à nos jours*. Paris: Publisher not indicated.

Collangettes, M.
1904 "Etudes sur la musique arabe," *Journal asiatique* 4:365-423.

Collective, ed.
1992 *Musique Arabe: Le Congrès du Caire, 1932*. Cairo: CEDEJ.

Dechevrens, Antoine
1898 *Études de science musicale I: IIe étude, appendice IV: de la musique arabe*. Leipzig: Breitkopf & Härtel [Reprint: Dr. Martin Sändig oHG, 1971].

Ellis, Alexander J(ohn)
1885 "On the Musical Scales of Various Nations." *Journal of the Society of Arts* 23:485-527.

Erlanger, Rodolphe D'
2001 *La Musique Arabe*. Paris: Librairie Orientaliste Paul Geuthner, 1930-1959. Reprinted with a preface by Christian Poché.

Fétis, François-Joseph
1869 *Histoire générale de la Musique I & II*. Paris: Librairie de Firmin Didot Frères, Fils et Cie. [Reprint, Hildesheim: Olms, 1983].

Helmholtz, Hermann L. F. von
1983 *Die Lehre von den Tonempfindungen als physiologische Grundlage für die Theorie der Musik* (6th ed. Braunschweig: F. Vieweg 1913). Hildesheim: Georg Olms (Transl. in English by A. J. Ellis under the title *On the Sensations of Tone as a Physiological Basis of the Theory of Music*. Dover, New York 1875-1998 (based on the 4th German ed. 1877).

Hornbostel, Erich M. von
1906 "Phonographierte tunesische Melodien." *Sammelbände der Internationalen Musik-Gesellschaft* 8:1-43.

Hornbostel, Erich M and Otto Abraham
1904 "Phonographierte türkische Melodien." *Zeitschrift für Ethnologie* 2:203-21.

Kiesewetter, Raphael Georg
1968 "Die Musik der Araber, nach Originalquellen." Leizpig: Breitkopf und Härtel (Martin Sändig oHG/R, 1842-1968, with a preface by Freinherrn v. Hammer-Purgstall).

La Borde, Jean Benjamin de
1780 *Essai sur la musique ancienne et moderne I* (chapters *"De la Musique des Persans et des Turcs; De la Musique des Arabes; Instruments des Arabes; Supplément à la Musique des Arabes*. Paris: Eugène Onfroy.

Land, Jan Pieter Nicolaas
1884-45"Recherche sur l'histoire de la gamme arabe," in *Actes du VIe Congrès International des Orientalistes tenue en 1883 à Leide,* II, 37-171. Leyden: s.l.

Lane, Edward William
1989 *An Account of the Manners and Customs of the Modern Egyptians, Written in Egypt During the Years 1833-1835*. London: East-West Publications/R, 1895 e \'ed., 1836. Reprint.

Neubauer, Eckhard
1989 "Musique arabe en France 1680-1830, esquisse chronologique des débuts de l'interêt français pour la musique arabe, sa théorie et ses instruments, " in *Le Monde Arabe dans la vie intellectuelle et culturelle en France*, 132-140. Paris: Institut du Monde Arabe.
1999 "Der Essai sur la musique orientale von Charles Fonton mit Zeichnungen von Adanson." *The Science of Music in Islam 4*. Frankfurt am Main: Institut for the History of Arabic-Islamic Science at the Johann Wolfgang Goethe University. Reproduction of a manuscript by C. Fonton and a reprint of articles published in *Zeitschrift für Geschichte der Arabisch-Islamischen Wissenscaften* 2, 1985:277-324 and 3, 1986:335-76.

Parisot, O.S.B. Jean Dom Marie-Jean
1898 "Musique orientale." *La tribune de Saint-Gervais*. April, 81-89 (Continuation of an article published in the previous month of March).
1899 *Nouvelles archives des Missions scientifiques et littéraires, choix de rapports et instructions, IX*. (Chapter: "Rapport sur une mission scientifique en Turquie d'Asie," 265-511). Paris: Imprimerie Nationale.

Poché, Christian
1989 "La musique arabe vue de France," in *Le Monde Arabe dans la vie intellectuelle et culturelle en France,* 121-31. Paris: Institut du Monde Arabe.

Riemann, Hugo, ed. A. Einstein
1929 *Musik-Lexikon*. Berlin: Max Hasses Verlag.

Rouanet, Jules
1922 "La musique arabe," in Lavignac, A., ed., *Encyclopédie de la Musique* V:2676-944. Paris: Delagrave.

Salvador-Daniel, Francisco
1986 *Musique et instruments de musique du Maghreb*. Paris: La Boîte à Documents.[A reprint of papers by F. Salvador-Daniel, including *La musique arabe* (1862-63)].

Sauveur, Joseph
1973 *Principes d'acoustique et de musique ou système général des intervalles des sons, II:* Annex IV. Paris: Minkoff Reprint.[*Mémoires de 1701 de l'Academie Royale des Sciences*].

Smith, Eli
1849 "A Treatise on Arab Music Chiefly from a Work by Mikhail Meshaka, of Damascus." *Journal of the American Oriental Society* 3:171-217.

Tiersot, Julien

1905 *Notes d'éthnographie musicale* (Chapter: "La musique des arabes)." Paris: Librairie Fischbacher. [Extracts from the publication *Ménestrel* 1900-1902; the chapter "La musique des arabes" was printed in 1902 and spread over 10 articles].

Toderini, l'Abbé

1789 *De la littérature des turcs*, transl. Abbé de Cournand, I: Chapitre XVI, De la Musique," 216-49. Paris: Poinçot.

Vaux, Baron Bernard Carra de

1891 "Le Traité des rapports musicaux ou l'épître à Sharaf ed-Dīn, by Ṣafī ad-Dīn 'Abd el-Mu'min Al-baghdādī (†1293/94)." *Journal Asiatique* 18:279-355.

Villoteau, Guillaume-André

1826 "Description de l'Égypte moderne," in *De l'état actuel de l'art musical en Égypte, ou relation historique et descriptive des recherches et observations faites sur la musique en ce pays*, rev. ed., XIV. Paris: C. L. F. Panckoucke [1st ed. 1812]

Weber, Max

1998 *Sociologie de la musique: les fondements rationnels et sociaux de la musique*. Introduction, trad. and notes by Jean Molino and Emmanuel Pedler. Paris: Éditions Métailié.