THE MODES OF ANCIENT GREECE

by

Elsie Hamilton

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P R E F A C E

Owing to requests from various people I have consented with humility to write a simple booklet on the Modes of Ancient Greece. The reason for this is largely because the monumental work “The Greek Aulos” by Kathleen Schlesinger, Fellow of the Institute of Archaeology at the University of Liverpool, is now unfortunately out of print.

Let me at once say that <u>all the theoretical knowledge I possess has been imparted to me by her</u> through our long and happy friendship over many years. All I can claim as my own contribution is the <u>use</u> I have made of these Modes as a basis for modern composition, of which details have been given in Appendix 3 of “The Greek Aulos”.

Demonstrations of Chamber Music in the Modes were given in Steinway Hall in 1917 with the assistance of some of the Queen’s Hall players, also 3 performances in the Etlinger Hall of the musical drama “Sensa”, by Mabel Collins, in 1919. A mime “Agave” was performed in the studio of Madame Matton-Painpare in 1924, and another mime “The Scorpions of Ysit”, at the Court Theatre in 1929.

In 1935 this new language of Music was introduced at Stuttgart, Germany, where a small Chamber Orchestra was trained to play in the Greek Modes. Singers have also found little difficulty in singing these intervals which are not those of our modern well-tempered system, of which fuller details will be given later on in this booklet.

I merely mention these performances as a proof that the Ancient Greek Modes can be used as a basis for modern composition, for they are built upon the natural law of sound itself, the only musical law which has been given us by Nature. In doing this I should also like to express the hope that other composers might be encouraged to make experiments in this fascinating realm.

Since 1933 I have had the invaluable help of my two Dutch friends, Wilhelmina Roelvink and Mary Wilbers, who with rare devotion and great self-sacrifice, have lifted much of the burden from my shoulders in training others and in forming centres in Stuttgart, Bremen, Ancona and Wynstones, thus making the continuance of the work possible.

In the splendid Preface to “The Greek Aulos” written by J.F.Mountford, now Vice-Chancellor of the University of Liverpool, unstinted praise has been given to this book by Kathleen Schlesinger. Among other assertions of the truth of her musical investigations, Mr. Mountford says:
“Miss Schlesinger needs no commendation to anyone who is aware of her established reputation as a historian of musical instruments, or who has read her important chapter on “The Significance of Musical Instruments in the Evolution of Music” in the Introductory Volume of the Oxford History of Music (1929). ... He goes on to say: “Though this book upsets many of our previous notions of the intervals of the Greek scales and especially of the way they were related to one another, there can be no doubt that all further study of Greek Music will be indebted to Miss Schlesinger’s pioneer work. It is, I venture to think, the most original and illuminating contribution yet made to a difficult and fascinating subject.

Further encomiums of Kathleen Schlesinger’s work are given by Dr. Ernest Marti of Basle, Switzerland, in an excellent treatise published in “Die Kommenden” (June 25th 1952) in Freiburg im Breisgau (where, incidentally we also gave performances in the Greek Modes) in which he refers to Kathleen Schlesinger as one of the greatest music scientists of the century.

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List of some of Kathleen Schlesinger's more important works:

1) 125 Articles on Musical Instruments in the Encyclopaedia Britannica.

2) The Instruments of the Orchestra and Precursors of the Violin Family, 2 vols., Ancient and Modern (out of print)

3) Chapter in the Introductory Volume of the Oxford History of Music. "The Significance of Musical Instruments in the Evolution of Music". (Oxford Press 1929).

4) The Greek Aulos (Methuen & Co., 1939)

Besides writing these books, Miss Schlesinger has given several series of Peripatetic Lectures in the British Museum and the Victoria and Albert Museum, South Kensington, which were enthusiastically received.

Chapter 1
A GENERAL SURVEY

It was in 1916, at a Summer School in Carbis Bay, Cornwall, that I first made the acquaintance of Kathleen Schlesinger, Fellow of the Institute of Archaeology in the University of Liverpool, and author of several important books, more than 125 articles on Musical Instruments in the Encyclopaedia Britannica; and of her latest and most important work, "The Greek Aulos" published in 1939.

Kathleen Schlesinger was due to give a series of lectures on the "Ancient Modes of Greece", and I felt that here at last I might find an answer to what had been puzzling me for years. Now we all know that any musical sound gives forth a series of harmonics or overtones, which do not correspond with the tones of our modern keyboard. I used to listen in Paris to an aeroplane which flew over my studio about noon each day, and which produced the most beautiful harmonics from a deep fundamental tone of F. This is what is called the Harmonic Series, which we all learn about, but then put away in a pigeon hole in our brain, perhaps never to be called forth again, as we have no further use for it. Nevertheless, this Harmonic Series is the only musical law which is given to us by Nature herself, and it rises first of all at the distance of an octave from the fundamental tone, then on to a perfect fifth, a fourth, a third etc., until we get such tiny intervals, called microtones, that the ear can no longer distinguish them.

Now why do we not use some of these wonderful tones in musical composition? This was my query, for we know that when a trumpet or horn, for instance, is blown <u>naturally</u>, a part of this Harmonic Series is always to be heard. It was with delight, therefore, that I heard from Kathleen Schlesinger's lectures that the Ancient Greeks <u>did</u> make use of these lovely tones, which she played to us on a Kithara, specially designed by her from a picture on a vase of this ancient Greek instrument.

In order to tune such an instrument to one of the great Planetary Modes or Scales, in use at the time of Pythagoras 600 BC, a monochord or tuning instrument was used which was divided into a certain number of equal divisions, according to the Mode one wished to hear.

The Monochord used by Kathleen Schlesinger at these lectures was indeed a primitive one, for it was none other than a blind roller, with 2 piano pegs, one driven in at each end of it, and between which an ordinary pianoforte string was stretched. This served the purpose, for it was easy to divide the space between the 2 pegs into equal divisions 11. 12. 13. 14. 15. 16 etc., and by stopping the string at certain of these divisions by means of a movable bridge, the surprising result was obtained of a series of scales, recognisable from ancient reed pipes still in existence, as some of the most beautiful and sacred of ancient tones.

But we must at once say that these Ancient modes, though needing the ascending Harmonic Series as a point of departure, were really built upon the Descending Harmonic series, which has the same intervals, or ratios, but in <u>reverse</u> order. That is, this series of tones starts from the <u>top</u> end of the monochord as divisions 1,2,3,4, etc. until the whole length of the string is reached, and according to the number of <u>equal</u> divisions made, so does one get one or other of the 7 great Planetary Modes, called the Harmoniai, which were in use at the time of Pythagoras.

For instance, the division into 11 or 22 equal segments would give us the Sun, or Dorian Mode, comprised within an octave in its diatonic form, and just as the Sun is the centre of our Solar System, so was this Sun, or Dorian Mode, the centre of the Ancient Greek Musical system.

Then, by dividing the string into 20 equal divisions, we obtain the Mars, or Hypolydian Mode; the Jupiter, or Hypophrygian Mode from its division into 18 equal segments, the Saturn or Hypodorian Mode from 16 divisions, the Moon or Mixolydian from 14, the Mercury or Lydian

Mode from 13, and the Venus or Phrygian, from 12 divisions of the string. Thus, according to the number of equal divisions on the monochord, do we get one or other of the 7 Planetary Scales, each having a distinct "Ethos" or character of its own; and a Kithara, one of the most beautiful of the old Greek instruments, can be tuned to the monochord so as to get a more sustained resonance for these tones.

So that we might say the ascending Harmonic Series is like an aspiration from the Earth to the Heavens, and that the descending Harmonic Series, on which the Ancient Modes of Greece were based, might be considered as an inspiration from the Heavens to the Earth.

Although no written records existed at the time of Pythagoras, much has been preserved through tradition and later writings, so that we know that he used a monochord to instruct his pupils, and that his last words were said to be, "Children, study your monochords".

Nevertheless, Miss Schlesinger is of opinion that the Modes came to birth long before even the time of Pythagoras, and in a very simple manner indeed; for in her book "The Greek Aulos", she points out that we can go back as far as 2800 B.C. to the silver pipes of Ur in Chaldea, which were excavated under the direction of Sir Leonard Woolley, and on which we find borings at equal distances and which, being made of silver have withstood the ravages of time. In fact, Miss Schlesinger gives a very ingenious explanation of how we may even be indebted to the humble weevil for the birth of the Modes on the ancient reed pipes, or Auloi, as they were called, for if a peasant in those times happened to cut a read which had already been pierced by a weevil, he would naturally be delighted to find he could produced a tone through the hole bored in the reed. And with the wonderful sense of proportion which the ancients possessed, and which we can find even in their designs on pottery, etc., what more likely than he would bore yet more holes in the reed at equal distances, thereby obtaining a different sound each time, and incidentally, though unconsciously, giving birth to one of the Planetary Modes, or at least a part of it. But we must not think the ancients used such abstract terms as we of the present day, and it was sufficient no doubt, for him to play and enjoy these tones without even knowing they were parts of the descending harmonic series itself.

This can be proved, however, by dividing a Monochord, for instance, into equal divisions, as explained above, for the principle is the same, though the manner of procedure is, of course, different from that on the reed pipes. Pythagoras and his pupils, who were known as the Harmonists, used those seven great Planetary Modes, called the Harmoniai, for they recognised a Planetary Deity, in each of the seven planets of the Solar System: Saturn, Jupiter, Mars, Sun, etc., and their chants and hymns were offered up to them at appropriate times of the day or night. Their training was a very strict and esoteric one, for Pythagoras was an Initiate who could even hear the tones of the Music of the Spheres themselves. But there was also an opposition School, known as the Theorists, who did all they could to upset the simplicity and purity of these ancient scales. Later on, in 300-400 B.C., Aristoxenus, one of these Theorists, made a written attack on the system of Pythagoras in his 12 polemics, in which he revealed a good deal of knowledge of the School of the Harmonists, so that Kathleen Schlesinger learnt quite a lot about them through these violent outbursts of Aristoxenus. Aristoxenus adopted the diatonic scale, as it was called, which consisted of a cycle of perfect fifths, but this is an abstraction, as we can never reach the octave again in order to have a diatonic scale within the octave, so some compromise had to be made. This went on and reached such complications that the purity of the 7 original Planetary modes was gradually lost.

The system itself was extended to 15 modes, the number of notes in the octave was doubled, or even trebled, until the time of Alypius 3 - 4 centuries AD, they were all documented in the form of the "Tables of Alypius", of which a diagram is given in "The Greek Aulos". Every tiny little interval had an appropriate sign or symbol, both for vocal and instrumental music, and the whole system was most ingenious.

Then we gradually come to the time of the Ecclesiastical Modes, where the very names of the original modes were confused by a writer called Glareanus, so that nowadays the Dorian Mode is spoken of as the Phrygian, and so on. In the early Christian Churches we find a primitive organ which gave the more “advanced” tuning, and at the same time a monochord was used when the choir sang a capella - without accompaniment - but gradually this was also overruled by the more imposing instruments such as the hydraulic organ, etc.

Have we then any traces of these Ancient Modes in our present well-tempered musical system? Yes, but in rather a mutilated form, for no two intervals in a Mode are of the same dimension, whereas in our well-tempered system we have only so-called tones and semi-tones.

In the Hypolydian (Mars) Mode, for instance, the first 4 tones (called a tetrachord) are very akin to the first 4 notes of our modern major scale, if we use ratio 15; the second tetrachord with ratios 13, 12, 11, 10, however, sounds vastly different. This comes about because the second half of our major scale is exactly like the first half. And if we use ratio 14 instead of 15 in the first tetrachord, as was also done in ancient times, then it sounds rather like the first half of our modern whole tone scale, though the second half is again different. In the Venus (Phrygian) Mode, we have also two alternatives by using the 15th or 14th ratio (equal division) for the second tetrachord, with ratio 15, bears some resemblance to our harmonic minor scale, or with ratio 14, to the melodic form of the minor scale. But with the 7 Planetary Modes we have not only 2 different experiences, as in our Major and Minor modes, but at least 7, for each of the Greek Modes give us an entirely different “ethos” or atmosphere, which is quite individual and peculiar to that Mode only, so that our musical experience is enormously increased thereby. This is one of the reasons why I have adopted the Greek Modes a basis for musical composition, and I have found enormous interest in experimenting with these natural tones and intervals. Other reasons are: (1) The Greek Modes are built on Nature’s law itself (the Harmonic Series) without any compromise, and a piano tuner finds it far easier to tune a piano to the Modes than in the ordinary way, with its complication of “beats” and so on. (2) The Modes offer a far greater variety in melodic, as well as harmonic, colouring, for if you play the same melody in the 7 different Modes you experience a distinctly different atmosphere each time, whereas in our modern well-tempered system it does not make much difference if we play the same melody in any or all the keys. A different harmonic system for the Modes is naturally required, and personally I build up harmonies in 4ths rather than in 3rds. (3) It has been proved by science that our middle ear answers to the same number of vibrations as are given us by using the philosophic pitch of 256 cps for middle C, instead of our modern concert pitch which to my ears sounds almost a semitone too high. So that one might conclude that our whole physique vibrates in sympathy with these natural tones, as it is built up on the same number of vibrations 256 cps with its octaves and harmonics above and below, as was the philosophic pitch of ancient times.

But I do not wish to dogmatise in any way. Some people who have been enabled to hear the old Modes think that our modern well-tempered system is a decided advance upon them. (Naturally there is no music extant from these very ancient times). Others again experience a rebirth while listening to the natural tones of these Ancient Modes, and are content to adopt them in their further musical work. The two systems represent two distinct musical worlds which are quite complete in themselves, and which only prove inimical one to the other if one tries to compare them by holding them both in the mind at the same time, instead of allowing each to work upon one through its own inner logicality. For instance, the music of the great classical composers is so wonderfully acceptable to us, not only because of the great inspirations which gave it birth, but also because its forms of expression are exactly suited to its musical basis. Thus, in using the Ancient Modes as a New language of music, we have a perfectly open field where no modern laws of melody or harmony need exist to disturb the composer in hi own untrammelled inspirations.

Who can tell whether they may not lead to a new revelation in the music of the future.

Chapter 2

THE GREEK AULOS

The fact that Kathleen Schlesinger considers the Aulos to be the originator of the Ancient Greek Modes has been challenged by some musicians and theorists, but I shall endeavour to mention some of the reasons for her doing so.

If exhaustive, and I might even say exhausting, proofs of her assertions are required they are given in her magnificent work: “The Greek Aulos”

What is an “Aulos”, we might ask and how has it deserved such an important place in the history of music? Children in the country can tell you that when they cut a simple wheat or oat stalk between two joints, they can produce a musical tone by blowing through it. They call it a “Squeaker”, but how wonderful is the thought that music itself is inherent in every reed or stalk of wheat and oat growing in the fields of Nature.

I have already mentioned in the Introductory Chapter of this booklet the simple and ingenious suggestion given by Kathleen Schlesinger as to how a hole might be accidentally pierced by an insect or grub of some kind and that a second note would sound from this hole which would be different in pitch from the one sounded through the whole of the reed.

In reference to one of these tiny reeds an interesting experience is related to Miss Schlesinger. On one occasion she invited the expert clarinettist, Mr D.J. Blaikley, to test the capabilities of a “new instrument”, asking him to turn his back while she played it. At the first booming note, an 8 foot C, he was struck by the beautiful tone, “like a bassoon”, he said. On turning to the “instrument” he was amazed to see a tiny oat stalk, some 4 inches in length, which had been responsible for this outburst of sound. The compass, sonority and beauty of tone produced by these straws is quite remarkable at times, some of them yielding several harmonics simultaneously.

Reed pipes are still to be found, especially where civilisation has not made itself felt, and they are invariably found with 3 or more holes pierced at <u>equal</u> divisions by some peasant or other, whose instinct to do this was inherent and almost unconscious. Numerous reed pipes of this nature have been brought to Kathleen Schlesinger from the wilds of Africa, Sicily, Bali, Peru, etc., on which a few holes are bored at equal distances in a perfectly natural way. For these reeds two different mouthpieces can be made, one which we can call a double-reed mouthpiece in which no incision is made, but by pressure of the lips the two parallel sides of the stalk are drawn together and flattened. This is unconsciously done in the “Squeaker”, but the astounding fact is that this simple device has been gradually divided into two separate divisions in the Double-reed mouthpiece of today, and so has become the progenitor of what is now used in the whole of the oboe family.

The second type of mouthpiece is not so simple as the first, for the reed must be closed either by a natural knot at one end, or artificially by sealing wax. In the latter case, even a lemonade straw can be used.

An incision is now to be made with a razor blade and a tiny tongue about an inch or so, cut away from the knot, which is then allowed to lie back flat against the mouthpiece. The narrower the tongue, the finer the harmonics produced. (In some of the old Arabian pipes the tongue was cut <u>towards</u> the joint so that the base of it was near it. But the elasticity and beauty of the harmonics was impaired thereby. This was called the arghool). In this second type of mouthpiece, which we may call a “beating reed” mouthpiece, we find the progenitor of that used in the clarinet family of today. These mouthpieces are very fragile and even temperamental, especially when one tries to find the fundamental tone to which they respond, and gradually we know that to improve their sonority and compass they were inserted into a stouter and larger reed of bamboo, etc. which acted as a resonator. The holes are now pierced in the resonator itself at <u>equal</u> distances, and the double-reed or beating reed was inserted into it, so that the length of the whole Aulos, resonator plus mouthpiece, should be an exact multiple of the equal divisions of the mode required; viz. 11 for the Dorian scale, 12 for Phrygian, 13 Lydian etc. These should be measured from the exit to the centre of each fingerhole and then to 1,2, or 3 equal divisions on the mouthpiece itself.

As these mouthpieces are very fragile, they are often absent in the reed-pipes (Auloi) preserved from antiquity, but, as <u>their length must be taken into consideration in determining the mode</u>, the secret of their importance has been lost through their having perished with age. This fact, so simple in itself, is one of the great discoveries of Kathleen Schlesinger, for to establish the name of the Mode, the mouthpiece <u>must</u> be present, for it constitutes an integral part of the Mode itself.

Being no longer there, however, in many of the ancient Auloi, the secret has escaped the vigilance of many research workers in this realm and has caused errors to be made in the discovery of the true nature of the Ancient Modes of Greece. The mouthpiece, which was called the pan-pipe, and even oraganon in ancient times, we shall now refer to as the "Syrinx", and the whole pipe, resonator and mouthpieces, as the Aulos itself. Bulbs to be seen on old specimens of the Aulos are merely decorative, their purpose being to conceal the extrusion of the mouthpiece from the pipe itself. The Syrinx (mouthpiece) should fit tightly into the resonator so that no air can escape. The Aulos, resonator and mouthpiece, was held in a vertical position and expert Auletes could manipulate 2 or 3 at the same time, one sometimes being held as a drone note.

An interesting account of a feat by Midas of Agrigentum at one of the Pythian Games, is described by Pindar in hi 12th Pythian Ode. "The little mouthpiece being accidentally broken by cleaving to the roof of his mouth, he continued playing on the reed along, thus changing the mode through the altered number of equal divisions, which so delighted the audience that he carried off the victory by this unusual and difficult feat."

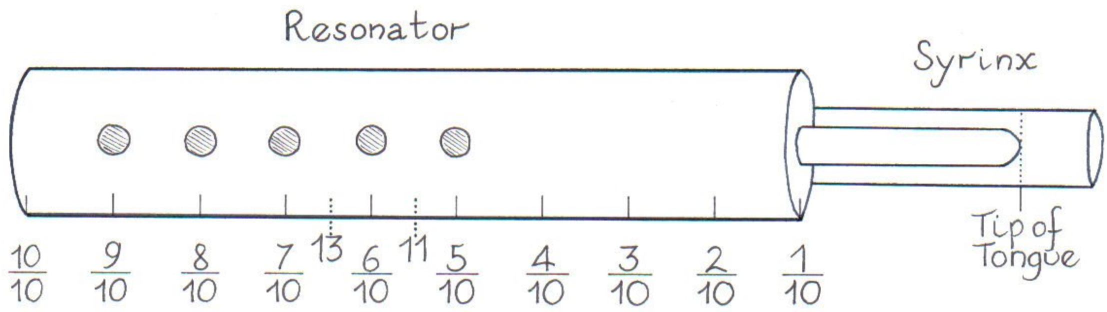
One might well ask why the honour of being the progenitor of the "Greek Modes" should be accorded to the Aulos (reed pipe) rather than to the ancient stringed instruments, or even to the voice itself. As regards stringed instruments, we know well their unreliability as recorders, for the tension of the strings is continually altering through changes of temperature, etc., so that no permanent or durable pitch is obtainable from them. In reed pipes (Auloi) and flutes, when once the holes are bored, they remain indefinitely at the same pitch without any variation.

Miss Schlesinger was permitted to make facsimiles of the Elgin pipes in the British Museum. They are bored with 6 holes at equal divisions, and date from 500 B.C. The interesting fact was that they gave forth an old form of the Dorian Scale, absolutely true to pitch. Miss Schlesinger is of opinion that as regards the voice, the influence of <u>speech</u> played a very important role, for although primitive song was based on the intervals of the Harmonic Series, the only musical laws given us by Nature), the interval was considered as a separate unit, connected in some strange way with fleeting emotional experience; each unity having been impressed on the singer through constant use in speech. In East Greenland an ancient tambourine was used to reinforce the tones of the speaking voice, and it undoubtedly gave forth intervals of the Harmonic Series, but there is no suggestion that owing to subtle changes in emotional feeling, which bring about the rise and fall of the voice, the speaker was conscious of this. There is also no evidence in primitive vocal music of graduated steps or scales such as can be obtained through boring holes at equal distances on reed pipes or flutes, which give out the same notes and intervals time after time and year after year. So that the primitive elements of a scale only exist in a <u>permanent</u> state in the scales of pipes blown by means of a primitive single or double reed mouthpiece made from wheat or oat stalk, when untreated and free from any fettering restrictions; also in flutes, trumpets and horns blown in a <u>natural</u> way. Wind instruments embody certain natural laws, operating by virtue of the demands of the instrument, and for these, formulae tested in theory and practice are to be found in "The Greek Aulos" by Kathleen Schlesinger.

The 3 following diagrams represent 3 types of Auloi with extrusion of the mouthpiece to 1,2 and even 3 increments of distance, or ratios, which lengthen the whole pipe and also change the mode, which was sometimes done while the Aulete was actually playing.

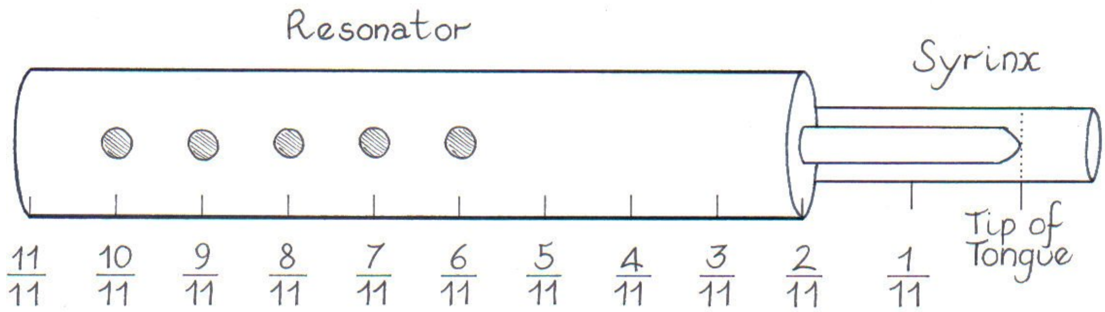
Diagram 1

Ancient Aulos, giving Hypolydian Mode



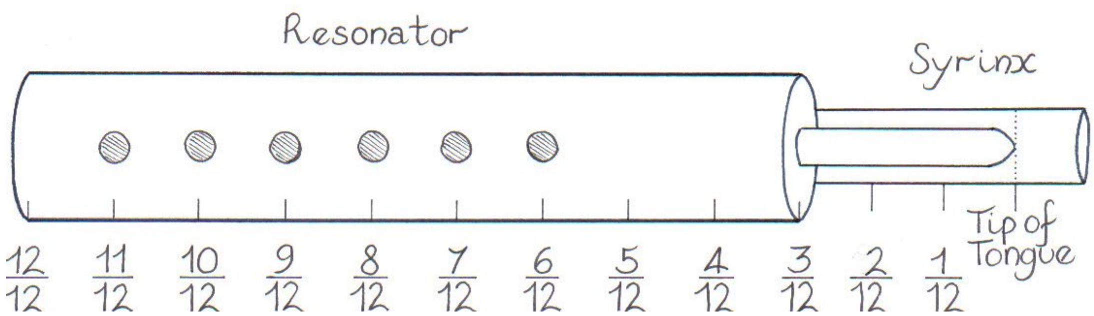
The pipe must be measured from tip of the tiny tongue to the exit in 10 equal divisions, with the mouthpiece at one increment of distance from the resonator. To get a complete octave scale a hole between 5 & 6 = 11 (perhaps on back of resonator) and between 6 & 7 (13) would have to be bored, as 7:6 and 6:5 are thirds.

Terpander Scale (Old Dorian)



Here the mouthpiece (Syrinx) has an extrusion of 2 equal divisions.

Old Phrygian Aulos



This mouthpiece has an extrusion of 3 increments of distance.

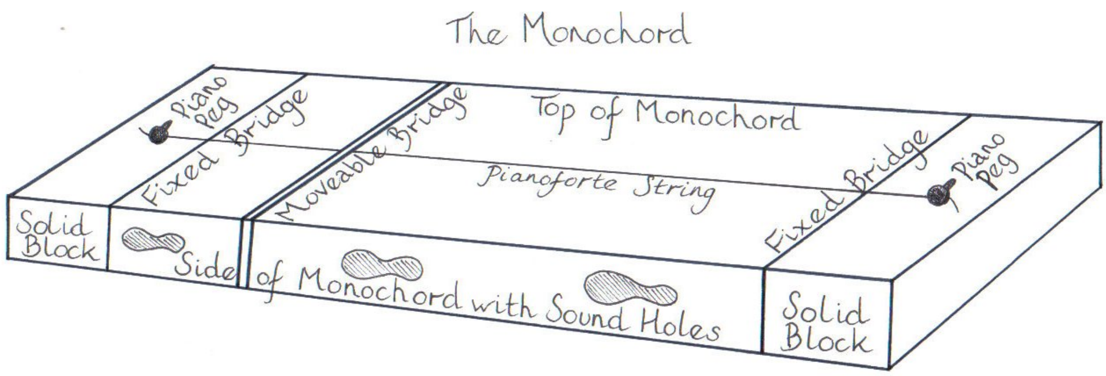
Chapter 3

THE MONOCHORD

The first requirement for understanding the Modes theoretically, is a Monochord, and we might now ask ourselves whether we have arrived at the Pons Asinorus so dreaded by students of Euclid. In reality, however, it is quite simple and should be easily grasped.

A monochord is a narrow box of pine or birch, about a yard or more in length and say 4 – 5 inches in width. A solid block of wood of stronger fibre, perhaps of beech is inserted inside the box at each end so as to sustain the tension of a pianoforte string attached to a tuning pin at each end of the monochord; an immovable bridge of wood, with a knife edge, is fixed about an inch inside each of the piano pegs or tuning pins, and a movable bridge of convenient shape, also with a sharp edge, will allow of its being moved freely under the string. The piano string can be of a thickness to give a C of 128 v.p.s, Viola C when plucked, but there is nothing arbitrary about all these measurements as regards length, width and string note of the monochord, which are only given as indications. The depth of the monochord should be about 4 inches, and sound holes are bored in the two sides. A key is naturally indispensable to turn the tuning pin to the pitch required.

The Monochord Diagram 2.



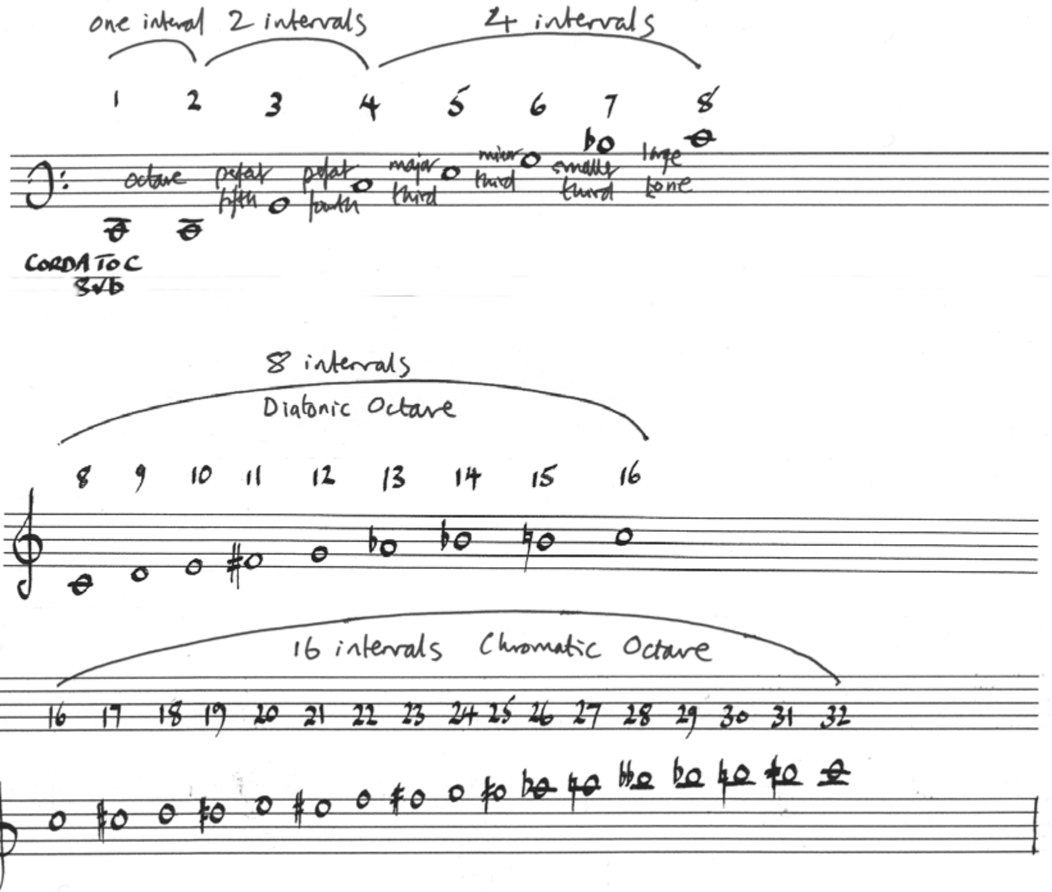
The Ascending Harmonic Series

Already in the Introductory Chapter, I mentioned how every musical note, struck or blown, give forth a series of harmonics or overtones which is known as the Ascending Harmonic Series. In ancient times the so called Philosophic pitch was used, viz. 64 v.p.s for Cello C, 128 for Viola C; and 256 for the middle C. As our own middle ear vibrates to these numbers, with their multiples, our whole physique should benefit greatly by responding to these natural proportions. Old instruments from all parts of the world, including the Chinese ones, have been found by Kathleen Schlesinger to respond to this philosophic pitch, and the whole of the Ancient Greek musical system was founded upon this natural law of harmonics.

The ascending harmonic series has a major character as the ratios 8,10, 13 give us a chord almost identical wit hour major one. In the descending series, the ratios 8,10,12 sound as a minor one.

One notices how the intervals gradually diminish as they ascend and rise upwards until the ear can no longer distinguish them. For our present purpose it is not necessary to continue them beyond the Chromatic Octave, to harmonic 32, the next octave called the Enharmonic, from the 32 – 64 harmonic being seldom used nowadays. One will also notice that the intervals within an octave become more numerous as we ascend, viz. only one interval in the 1st octave, 2 in the second, , 4 in the 3rd, 8 in the diatonic octave, 16 in the Chromatic Octave, and 32 in the Enharmonic one. Thus, only the number of intervals is doubled with each octave, and no two of them are of the same dimension. The only ones which in any way correspond with our well-tempered system, and then only approximately, are the perfect fifth, ratio (interval) 2:3; the perfect 4th, ratio 3:4; the major 3rd, ratio 4:5; the minor 3rd, ratio 5:6; the diatonic tone 8:9; diatonic semitone, 15:16. The interval 7:8, called the septimal tone, is larger than an ordinary tone on the pianoforte; the fifths in our well-tempered system are slightly flatter than a perfect 5th, and the thirds are slightly larger.

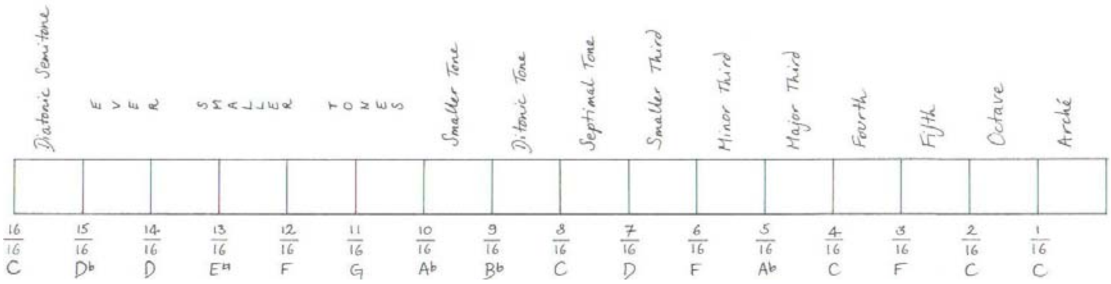
<u>Diagram 3</u>



A compromise has to be made in the tuning, otherwise we should never reach the octave again, which is essential for a diatonic scale, but which occurs quite naturally in the Harmonic Series. To find the Ascending Harmonic Series on the monochord, one divides it in ½ to get the octave ratio 1:2. (One can mark the numbers on top of the monochord itself). To get the fifth, ration 2:3 by dividing into 1/3 of its length; ratio 3:4 – ¼ of its length; and then on to 1/5, 1/6, 1/7, 1/8 until finally the intervals are too small to be measured. This is common knowledge to many musicians and even physicists, but what is not so generally known is that there is also a <u>descending</u> harmonic series in which the ratios, or intervals, are exactly of the same magnitude as in the ascending series, but in <u>reverse</u> order. And it is on this descending series that the Modes of Ancient Greece are based, <u>but we must never forget the golden rule that equal divisions do not produce equal intervals either in the ascending or descending series</u>.

The Descending Harmonic Series

Diagram 4



One naturally might wonder why the procedure for marking the Ascending Harmonic Series on the Monochord is so opposed to that of the Descending Series. We obtain the first by unequal divisions of ½, 1/3, ¼, 1/5, etc. of the monochord, and the second by strictly equal divisions required for a special mode. There is in reality no discrepancy at all, for the octave ratio 1:2, with its multiples 2:4, 4:8, 8:16 etc., is invariably the same whether it occurs in the ascending or descending series. The same with the ratio 2:3 or its multiples 4:6, 6:9, 8:12, etc., which is always a perfect fifth, wherever we might find it, and so on. Even the number of the harmonic tallies, as they proceed in arithmetical order in both diagrams; 1,2,3,4,5,6,7,8, etc. The difference is that in the descending series we proceed from the top end of the monochord downwards to the string note, with the intervals gradually decreasing, whereas in the ascending series we proceed upwards from the string note, with the intervals gradually growing smaller. As I have already explained, in order to create a Mode we need both the ascending and the descending series. From the former we choose our keynote, the creative tone, the Arché, the number chosen determining the Mode. For instance, if we choose the 16th harmonic, which would be a high C, if the string note is C, we get the point of departure downwards for the Saturn, or Hypodorian Mode. The whole progression is called a Tropos, which literally means a “turning”. So that there is here a fundamental difference between a Mode and our modern scale in that in the latter the tonic is also the keynote, whereas in a Mode the tonic, or whole string note, forms an interval with the keynote or Arché, chosen from the Ascending Harmonic Series, and which is different for each of the 7 Planetary Modes.

For instance, if the Tonic or string note is a C, then the Dorian or Sun Mode would have the 11th harmonic, a sharpened F, as its keynote, and there is a different interval between tonic and keynote for each of the Modes. The Phrygian or Venus mode is built on the 12th harmonic, and has G for its Arché, a perfect fifth from the tonic; the Lydian or Mercury Mode, a flattened 6th or the 13th harmonic in the Ascending Series; the Mixolydian or Moon mode a flat 7th or 14th harmonic for the keynote; the Hypophrygian or Jupiter Mode the interval of a second between the Tonic and its keynote; an the Hypolydian or Mars Mode, a Major third with its keynote. It is strange that although many people can hear tones of the Ascending series proceeding from one single tone, I have only met one composer who was to some extent conscious of the descending harmonic series. This was the fine Russian composer, Georg von Albrecht, Professor at the Stuttgart Conservatorium of Music. Our modern ears have become blunted to these spiritual tones, but they can be reawakened in our consciousness. We must here mention a very common mistake even among some musical theorists, and that is that the poor Greeks always had to sing or play downwards. We can not see how this error has arisen, for the derivation of the Modes, the Tropos, was certainly a downward progression, as explained above, but there was nothing to prevent the Greeks from playing or singing their Modes upwards as well as downwards. To stop the string at the various numbers required in playing a Mode, the movable bridge is held in the left hand and the plucking is done with the right. This enables it to pass freely under the string.

Chapter 4

THE SEVEN GREAT PLANETARY MODES (HARMONIAI)

I have already mentioned the 7 Great Planetary Modes, called Harmoniai, which were in use at the time of Pythagoras about 600 B.C.

A mode is comprised within an octave starting from the whole string note and it consisted of 2 tetrachords, each composed of 4 tones or 3 intervals, with a tone of disjunction, as it was called, between them. The 7 planetary scales were known as:

Dorian (Sun Scale)

Phrygian (Venus)	Hypolydian (Mars)
Lydian (Mercury)	Hypophrygian (Jupiter)
Mixolydian (Moon)	Hypodorian (Saturn)

A very old form of the Dorian Mode was known as the Terpander Scale, and bore the ratios 11.10.9.8.7.6 which, as we can see does not reach the octave which would have to be 5½, and also the 7.6 interval is not a tone but a very small third. Later, by doubling the number to 22, we get the octave form of the Dorian Scale 22.20.18.16 14.13.12.11. with the tone of disjunction 16.14 between the two tetrachords. One notices that after the 16th harmonic one has to use ratios of the Chromatic Octave which however are only multiples of the tones of the diatonic octave. For instance 22.20 18.16 are simply the doubles of 11.10.9.8, and were also common in ancient times. The chromatic tones such as 21.19.17, etc., are not used in a true mode, which proceed by step as in the diatonic octave. The Phrygian Mode built on the 12th harmonic, a G on a C string note, needs also to be doubled to complete the octave for in its simple form as 12.11.10.9 8.7½.6½.6 we avoid fractions by doubling 24.22.20.18.16.15.13.12, and thus simplifying matters. So far, we have not found a notation suitable for our modern needs, and as the player has quite enough to master in learning the unusual intervals of the Modes, I have used the ordinary notes of our modern scale <u>which approximate most nearly to those of the Modes</u>, though they never coincide <u>exactly</u> with them, not even the string note, unless we adopt the philosophic pitch of 256 v.p.s for middle C, which is never done, for the sharp concert pitch of today rises to 259.49 v.p.s for middle C. Perhaps some inventive mind will one day create a special notation for use in the Modes. Meanwhile, we must be content to use them in their approximated notation.

<u>Saturn</u> (Hypodorian Mode)

16	15	13	12	11	10	9	8
F#	G	A#	B	C	D	E	F#

The 2nd tetrachord 11.10.9.8. sounds rather like the whole tone scale of the Chinese, adopted by Debussy.

<u>Jupiter</u> (Hypophrygian Mode)

18	16	15	13	12	11	10	9
E	F#	G	A#	B	C	D	E

<u>Mars</u> (Hypolydian Mode)

20	18	16	14	13	12	11	10
D	E	F#	G#	A#	B	C	D

Both ratio 15 and 14 are never used together in the same mode, but there are two forms of the Mars Mode, the earlier one with ratio 14 and the later one with ratio 15. This later one is the prototype of our modern major scale, which has lost its original purity.

Sun (Dorian Mode)

22 20 18 16   14 13 12 11
C   D   E   F#   G# A# B   C

This was the principal Mode in the old Greek Musical System.

Venus (Phrygian Mode)

24 22 20 18   16 15 13 12
B   C   D   E   F# G   A# B

Again 2 forms of this Mode. With ratio 15 it is the prototype of our harmonic minor scale; with ratio 14 or our melodic minor scale.

24 22 20 18   16 14   13 12
B   C   D   E   F# G# A# B

Mercury (Lydian Scale)

26 24 22 20   18 16 15 13
A# B   C   D   E   F# G   A#

Moon (Mixolydian Scale)

28 26 24 22   20 18 16 14
G# A# B C   D   E   F# G#

The moon scale must always have ratio 14, not 15.

The Modes as Species

You will notice in the list of the Modes just given that each Mode begins on a different note. This was a very usual practice among the Greeks and for very obvious reasons. For if we began all 7 modes on the same not, a C for instance, we should inevitably get 7 different Ds, 7 different Es, etc., which would be impossible to obtain all on one instrument. In the case of the flute, matters would be even worse, for we would need 7 different flutes to get the 7 necessary tones, and this would be an impossible feat for one player. So the simple expedient was resorted to of obtaining all 7 Modes on one instrument, by allowing each Mode or, more strictly speaking, Species, to begin on a different note.

For instance, take a Moon Mode with 14 divisions, or even 28, we can get the other 6 Modes, as species, within it, e.g. –

Moon Mode	14	13	12	11	10	9	8	7				starting on C
Lydian Species		13	12	11	10	9	8	7½	6½			starting on D
Phrygian Species			12	11	10	9	16	15	13	12		starting on E
Dorian Species				11	10	9	8	14	13	12	11	starting on F#

The Arché, called Mese, when occurring in the Octave Scale itself, always falls on the number 8 or 16 (doubles are of no consequence) and when Modes are used as Species this Mese is the same for all 7 Scales, but when all the 7 Modes have the same tonic, or string note, then the Mese falls on a different note for each Mode (see Diagram 5).

In our use of the Modes in composition, we have taken the Dorian Mode on a C string as our model, and have used the other 6 Modes as Species within it. there is nothing arbitrary in this, but as the Dorian was the principal Mode of the Greeks, and has that delightful interval of the sharpened 4th between the string note and Mese (an F, which is the keynote of Nature), it has served our purpose very well. Using ordinary notation, the result is as follows:-

Dorian Mode	C	D	E	F#	G#	A#	B	C			
	22	20	18	16	14	13	12	11			
Hypolydian		D	E	F#	G	A#	B	C	D		
Species (Mars)		20	18	16	15	13	12	11	10		
Hypophrygian			E	F#	G	A#	B	C	D	E	
Species (Jupiter)			18	16	15	13	12	11	10	9	
Hypodorian				F#	G	A#	B	C	D	E	F#
Species (Saturn)				16	15	13	12	11	10	9	8
Mixolydian					G#	A#	B	C	D	E	F#	G#
Species (Moon)					14	13	12	11	10	9	8	7

The Moon and Saturn Modes are the only ones which are complete within the diatonic octave. Diagram 5 shows the 7 Planetary Modes (Harmoniai) when all are taken on the <u>same</u> string note, C. When taken as Species, although the same 8 notes occur in each one, the difference in “ethos” through beginning each one on a different note is still remarkable.

Another great difference between a Mode and an ordinary scale in the well-tempered system, is that in the latter we have two tetrachords practically alike, C, D, E, F G, A, B, C, the second one starting on the dominant, whereas in a Mode, the second tetrachord is very dissimilar from the first, so that in the Mars Mode, the first tetrachord which resembles our own major scale, of which it is the progenitor, the second tetrachord is vastly different. This is, of course, because no two <u>consecutive</u> note in a Mode are of the same magnitude and become larger as we ascend.

A very interesting confirmation of how one Mode evolves out of the last part o the one before, as discovered by Kathleen Schlesinger, is given us by Rudolf Steiner in his own cosmology.

Saturn 16. 15. 13. 12. 11. 10. 9. 8

Sun 11. 10. 9. 8. or 22. 20. 18. 16. 14. 13. 12. 11

Moon 14. 13. 12. 11. 10. 9 .8. 7.

Mars 10. 9. 8. 7. or 20. 18. 16. 14. 13. 12. 11. 10

Mercury 13. 12. 11. 10 or 26. 24. 22. 20 18. 16. 15. 13

Jupiter 18. 16. 15. 13. 12. 11. 10. 9.

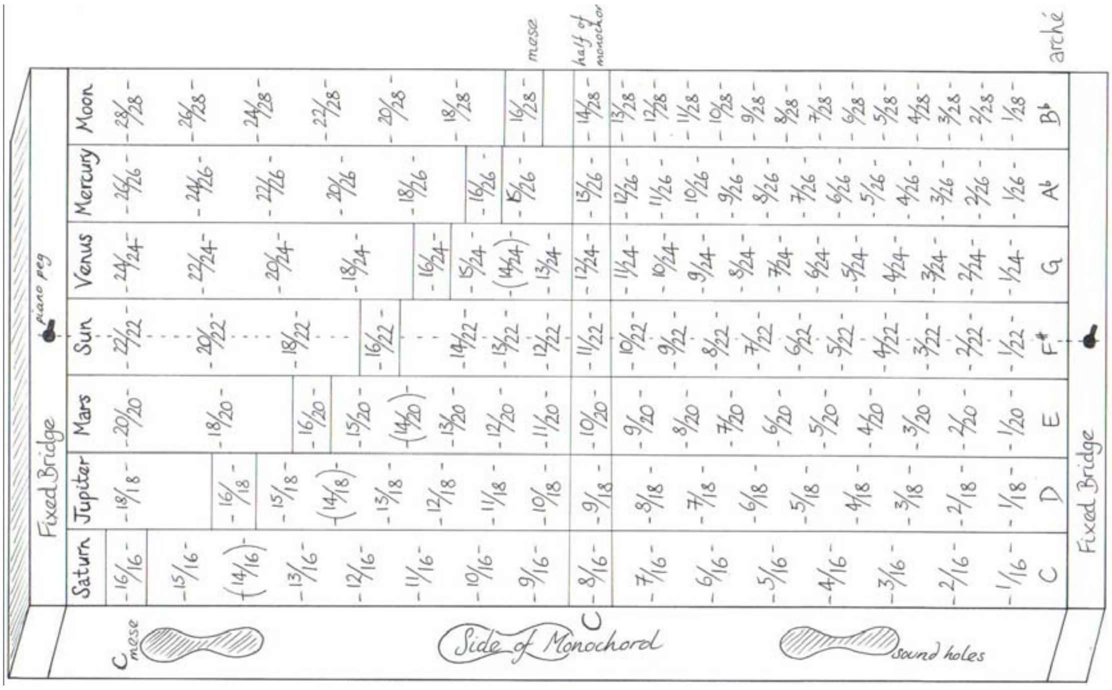
Venus 12. 11. 10. 9. or 24. 22. 20. 18 16. 15. 13. 12.

Vulcan A repetition of Saturn on a higher spiral

Strangely enough, the unit in our modern scale is considered to be a tetrachord, as both tetrachords are alike. In the Modes, the unit is spoken of as an <u>octave</u> relationship, as both tetrachords are dissimilar.

The 7 Modes when taken on the same String Note, C

Diagram 5



No accuracy is claimed in the measurements of these equal divisions which are merely given as indications. The dotted line running through the numbers represents the pianoforte string under which the movable bridge can be stopped at the divisions required.

The keynotes of the seven Modes can be found on ratios 1, 2, 4, 8, 16 in each Mode and by following the keynotes (16) in each mode one gets the notes of the Ascending Harmonic Series: C D E F# G Ab Bb which gave the modes birth. The Saturn mode is the only one in which the String Note coincides with the keynote, (Mese).

Chapter 5

THE KITHARA

In "The Greek Aulos", Kathleen Schlesinger writes: "The Kithara was a revered tradition connected with the most glorious and noble period of the history of their country's civil and religious life. The Greeks who so jealously cherished the Kithara, having adopted it and exalted it above all other stringed instruments, were alone capable of carrying out the evolution guided by a fine appreciation of the aesthetic proportions and peculiar construction of the Kithara, no less than by national pride." Originally coming from the East, the evolution of the Kithara, as explained so wonderfully in K. Schlesinger's "Precursors of the Violin Family", gave forth as offshoots the rotta, crwth, guitar, guitar-fiddle, (13th century), the viol family and finally the violin. Of a
graceful shape, as depicted on many of the old Greek vases, from which copies have been made for our little orchestra, it possessed strings varied in number from 7 – 15 all of equal length. The Egyptians, though borrowing the idea from the Greeks, altered it by making the form with graduated length of strings which is now known as the harp, to which they remained faithful, whereas the Greeks continued to use the Kithara as their favourite instrument.

Saul is depicted as threatening David, who is playing upon a Kithara of somewhat primitive design, but having 14 or 15 strings. A design of the oldest Kithara which is still in existence in the Louvre (Salle Sarsec) was found on a bas-relief in the palace of King Gudea 2700 B.C. It depicts a woman playing a Kithara of 11 strings, with 11 huge tuning pins and very strong supports, on which is also carved a bull of appropriate dimensions.

The earliest picture of a guitar was found on a Hittite slab dating from 1000 B.C., on which was also carved a bagpipe in the shape of a dog. An interesting discovery of an Egyptian lute was found on a little terracotta figure by Professor Flinders Petrie in 1906, in the cemetery of Goshen. It is now in the Ashmolean Museum in Oxford. The lute was originally brought from Persia by the Arabs, who were largely imitative, but not creative. The lyre was also a favourite of the Greeks and was plucked with the fingers as was also the Kithara. It is said that Pythagoras added an 8th string to his 7-stringed Kithara, thus completing the octave. In these times, players had a single Mode on their Aulos or their Kithara. An aulete or Kithara player from Athens would have the Dorian Mode on his instrument, one from Phrygia, the Phrygian Mode, and a third from the province of Lydia, the Lydian Mode. At the Pythian Games the various players and singers would assemble, and perhaps the Kitharists might envy one another's scales and would like to play them also. Thus more strings were gradually added to their Kithara, so that this might come about.

For instance, the Dorian Kithara with 8 strings:

22	20	18	14	13	12	11
C	D	E	F#	A#	B	C

would give a Phrygian Scale by adding a string below the Dorian 22, so that we should have –

24	22	20	18	16	15	(or 14)	13	12
B	C	D	E	F#	G	(or G#)	A#	B

The added note was called the Proslambanomenos, and may have been the reason why, in later times, the Dorian Scale was confused with the Phrygian.
Then, with yet another string below the 24, they could get the Lydian Scale, (Mercury).

26	24	22	20	18	16	15	13
A#	B	C	D	E	F#	G	A#

And yet another string below that would give them the Moon Mode.

28 26 24 22 20 18 16 14
G# A# B C D E F# G#

Of course these added Modes are only species of the main Dorian Mode, as they all start on a different not taken from the Dorian Mode, but as Species they all have the same Mese, 16, as has already been explained in Chapter 4.

By adding a string above the Dorian Mode we get –

22 20 18 16 15 or 14 13 12 11 10
C D E F# G or G# A# B C D

The Hypolydian Mode as Species of the Dorian from 20 – 10.

The Hypophrygian Species form 18 – 9.

18 16 15 13 12 11 10 9
E F# G A# B C D E

The Hypodorian Species from 16 – 8.

16 15 13 12 11 10 9 8
F# G A# B C D E F#

Mixolydian Species (Moon) from 14 – 7

14 13 12 11 10 9 8 7
G# A# B C D E F# G#

So we see from the Dorian Mode, the central one of the old Greek Musical System, we can get all the other 6 Planetary Modes as Species by adding more strings above and below the original 8 ones at the time of Pythagoras. This applies to the other Modes as well.

The same development went on among the Auloi and the Flutes – although, of course, one is limited by the number of one's fingers, by overblowing and cross fingering, and in our little orchestra we have flutes made to give the special notes of the Mode, which can also be played as Species. As time went on the purity of the 7 Harmoniai, Planetary Scales, was gradually lost and the number of scales was increased to 15 and was called the Greater Complete System.

There was also a Conjunct form of the Mode, without the tone of disjunction between the two tetrachords, and this necessitated an added note which I have already referred to as the Proslambanomenos, so as to complete the octave. This may have been a yet more important reason why the names of the Modes became confused, for say we have a Conjunct Dorian Scale with ratios:

11 10 9 8 7 6 5½ (or 11)

then by adding the 12th note as Proslambanomenos, we now have a Phrygian Scale with the ratios –

12 11 10 9 8 7 6½ 6

thus making the Proslambanomenos, 12, an integral part of the scale. In the Ecclesiastical Modes the Dorian Mode was thus displaced by the Phrygian Scale and became the 4th Plagal of the Greek Church, which possessed 4 Plagal and 4 Authentic Modes, known in the West in the 8th century at the Court of Charlemagne. But his would take us beyond the scope of the present booklet, which is mainly concerned with the 7 great Planetary Modes in their simplest form, as in use at the time of Pythagoras. If more details are required they will be found in the magnificent book: “The Greek Aulos” by Kathleen Schlesinger, wherein the Tables of Alypius show in a diagram the more complicated Greek Musical System as it developed in later times, and in Appendix 1 or 2 more details as regards the Ecclesiastical Modes.

As will have been seen, there is no Mode built on the 15th Harmonic of the Ascending Series, its sole use being to serve as an alternative, in some of the Modes, to ratio 14.

The Kithara, of course, is easily tuned by stopping the various ratios of the mode required on the monochord, which is purely a tuning instrument, and by then tuning the Kithara strings to the same pitch.

The larger Kitharas will give deeper tones than the alto or soprano Kitharas, and the number and thickness of the strings should be in accordance.

Chapter 6

THE FLUTE

The study of stringed instruments is perhaps more attractive than that of wind instruments, but its value in knowledge of the evolution of art and musical science is less. For the unreliability of strings to keep their exact pitch, as already stated, owing to changes of temperature and the uncertain tension of the strings, renders the value of a stringed instrument, as a record, negligible. The flute offers a complete contrast to the more delicate Aulos and was not such a favourite as the latter in Grecian times. The old Egyptian flute, called a “Nay”, held vertically, was cylindrical and was blown like the Aulos with lateral fingerholes. Flutes must have a cylindrical bore, or inner diameter. Sometimes this is deceptive, as a thickness in the outside wood of the flute may not mean that the inner diameter is uneven. Some very fine flutes have been made to give the Dorian Mode on C and other Modes as species.

Another flute was shown me, made of glass, by a young Austrian, and had a very fine tone indeed. If the whole Flute does not give the note required, a hole can be bored a little higher up the flute and used as the actual vent or exit. In the “Sensa” flutes, made for the performance of the drama “Sensa”, the exit hole or vent is an E, as the tonic of the Hypophrygian Species within the Dorian Mode itself. Equal divisions are bored in the flute from the centre of the embouchure to the centre of the vent hole to get the octave scale, and to facilitate matters the A# , 13th harmonic, is stopped by the thumb, on the underside of the flute.

There are fewer harmonics obtainable on the flute than on the Aulos, and no very useful information about either of them is to be had much before the end of the 14th century, when we are told they were used in the West and had 6 fingerholes. The scales themselves still persisted among the Folk until the middle of the 16th century, and even today there are places like the Hebrides and other parts, somewhat remote from civilisation, where the older generation can still sing their Folk Songs in their true intonation, though they sometimes have to bear the reproach from their more “educated” children and grand-children that they are singing “out of tune”! At any rate, ancient pipes and flutes still exist which give forth this natural, of out-of-date, intonation, and we owe a special debt of gratitude to the peasant flutes, which, having no mouthpiece, like the Aulos, to perish with age, provide a very safe story in later times of the development of music throughout the ages.

The panpipe also suggests the Harmonia as its origin. It was held vertically in front of the mouth and blown across the open end of the pipe and in the earlier Greek writers, even down to Plato and Aristotle, the existence of the Harmoniai was freely referred to Harmonia – octave scale.

But is must not be thought that the Greek Modes are to be found all over the world of today. We speak of the “Greek” Modes because the Greeks were the first to provide us with a finely elaborated musical system, with every note or interval exactly accounted for, and although we can imagine that the whole world in very, very ancient times had only the one natural law, the Harmonic Series, given by Nature herself, to express their musical inspirations, the musical development of the various nations, just as their people have taken on a “national” colouring, so that we have Chinese scales of Heaven and Earth, Yang and Yin, consisting of whole tones, one starting on C and the other on C# and which were founded on the 11th harmonic of the Ascending Series, which is a sharpened F, and is actually the tonic of Nature itself. We have here departed from the actual tones of the Tropos, and again in the 22 Shrutis of the Indian Scale we are indulging more or less in abstractions, as there are no 22 equal intervals in any octave, though this system no doubt suits the metaphysical nature of the Indian race. Even in some native races, the Maoris, the Aborigines, etc., with their minute and very complicated intervals, it is difficult for a European mind to recognise any co-ordinated system, though no doubt it is quite self-evident to themselves.

As for our modern, well-tempered system, to say nothing of atonality, it is hard to reconcile them with any laws which have a natural origin, though they have served their day and generation most admirably.

So I have endeavoured in this pages to offer a new-old musical language which, though speaking from a far-off past, yet has the advantage of having a natural as well as a spiritual origin.

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NOTE:

One is often asked how one knows that the Planet Saturn e.g., has a relationship to the Hypodorian Mode; the Planet Jupiter with the Hypophrygian Mode and the Planet Mars with the Hypolydian Mode etc.

To answer this, one would have to go back to the Ancient Chaldean Age, when the Wisdom of the Gods was still imparted to the Initiates of old and from this source Pythagoras also received this knowledge which we was able to impart to his pupils in his esoteric school in Greece, about 600 B.C. Perhaps in ancient Greek writings traces of this teaching might be found; but Kathleen Schlesinger, in her monumental work “The Greek Aulos”, might not have mentioned this connection of the Greek Modes with the Planets because she was up against the most hardened and materialistic thinkers of the day, who might have considered such knowledge charlatanry, which would have been highly distasteful to one of her scientific habits of though. For only through tradition could such ancient teachings be handed down to us; but the modern mind is too clever to accept anything which cannot be proved scientifically.

I accept full responsibility for this statement, as my dear friend Kathleen Schlesinger, is no longer with us to answer this question herself.

E.H. 1953