PHYSICAL THEORY OF MUSIC

THE MUSICAL INTERVALS OF INTEGER NUMBERS OF PYTHAGORAS AND THE NON INTEGER INTERVALS OF EUROPEAN MUSIC

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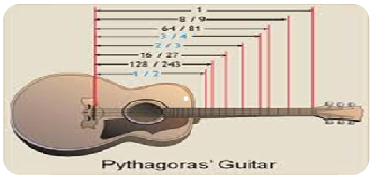
Pythagoras observed that strings (with the same tension and thickness) with small integral ratio of their lengths produce fine-sounded sounds.

The Pythagoras introduced the philosophical view that music based on tetraktis of cube (6,8,9,12) and the harmony of integer numbers. So, he built a scale of notes based on the ratios of the numbers 6, 8, 9, 12 and on their combinations.



This scale contains a natural harmony. In this based the Byzantine music and traditional Greek music.

The problem is that given a fixed ratio of two integral numbers between two sequential sounds, we can't double or quadruplicate the frequency

(It's impossible for an octave to be constituted!) That is why this music scale supports Mono and not polyphonic music.

During the Renaissance, musicians divided an octave into 12 **«equal» parts (semitones).** When we say "equal" we mean that the sequential notes **have the same frequency ratio and not the same difference**.

So, the frequency ratio of the first and the last note will be ½, while the intermediary ones will all own the same frequency ratio which is proved to be the twelfth root of the number 2. This is known as ***integration***

In this way, we can have a choir of many instruments playing simultaneously the same melody starting from a different base.

Furthermore, we thought that we could elaborate more on what would happen if we separated the octave in **10 «equal» parts** instead of 12.In that case, the frequencies ratio of the two sequential sounds would be the tenth root of 2. We did that because we noticed that the ratio of the first and the seventh note is ***Phidias's number φ***.

Thus, we constructed Pythagoras's tetrachords and one major scale of European music with 8 spaces (tone-tone-semitone-tone-tone-tone-semitone). We observed that most of Pythagoras's sounds are included in European musicthe two sequential sounds would be the tenth root of 2. We did that because we noticed that the ratio of the first and the seventh note is ***Phidias's number φ***.

Similar constructions were made with tubes, cut out in specific lengths so as to correspond to the above mentioned scales.

As regards to the constructional material, we needed to have a string with equal thickness and tense in order to use specific parts of it, to see which notes are produced when is pulsed.

For that reason, we used pulleys to maintain the same tense, as well as riders on rails, to move them adjusting precisely the length. With a turnbuckle, we adjusted the tense of the string and thus change the «tuning»..