Employment of Multicultural and Interdisciplinary Ideas in Ear Training ("Microchromatic" Pitch. "Coloured" Pitch)

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ABSTRACT

This paper offers a description and demonstration of the colored representation of the relative music scale as well as computer program for equal 29-temperament.

The author of this treatise proposes the model of the musical scale, expressing the reciprocal relationship of attraction and repulsion between the degrees of elevation on the musical scale.

The model comprises 5, 7 and 12 different notes for every key, identical to the European and a number of Non-European musical systems of pitches; 17 different notes for every key, identical to the Arab-Iranian system; and 22 different notes, identical to the Indian system "sruti."

This model, elaborated in all the keys, would give rise to a system of notes that is inordinately complicated. A necessary and sufficient condition for the problem would be a 29-tone temperament. A suitable keyboard is suggested.

The nearby sounds are located at intervals of a fifth, a fact that corresponds to the greater proximity of fifth-interval sounds (the slightest interference of sound waves arises in contemporary resonance). As colours near to one another, we mean those that are next to each other in the spectrum. The author represents a spectrum of 12 colours, which should correspond to the chain of 12 fifths. This coloured chain is condensed into chromatic scale.

After several years in which children have contact with coloured representations of a musical system (and a special notation board as well), they begin to have relative associations as regards the "coloured" pitch (short video).

KEYWORDS

ear training, synesthesia (synaesthesia), multiculturalism, early childhood, teacher Training

1.

Using graphics is nothing new for music educators. Traditional music notation is, in itself, a graphic representation. Common models of the musical scale often look like a staircase. An example of this is the Bulgarian model (Peev & Krisčeva, 1967). Another category of pictorial models includes the image of the piano keyboard, antique "tablatures," and also the graphic representation of guitar chords designed for amateurs. All these models have the same flaw, that is, they do not express the reciprocal relationship of attraction and repulsion between the degrees of the musical scale. The author of this treatise intends to propose the following model, easily used with all tonal scales, but for the sake of clarity represented here in C major (C minor) (see Figure 1).

Figure 1

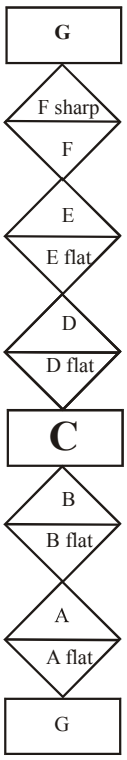

Figure 1.

The fact that the tonic is located in the centre of the system should not create confusion. This model (intended for children) is used for ear

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training through singing, and repertoire to be used for *sol-fa* is arranged such that the tonic assumes a central position in the melody. This model serves as the base reference for all the natural authentic modes (Ionian, Lydian, Mixolydian, Aeolian, Phrygian, and Dorian) and also for the scales that contain altered degrees. In everyday practice, the author uses the model for major mode and natural minor mode (see Figure 2).

Figure 2

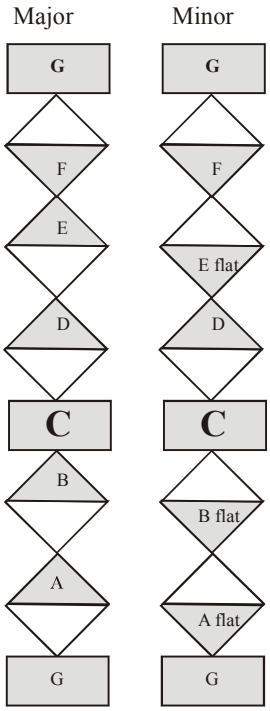

Figure 2.

In lessons with children, we name these models "major house" and "minor house". The first year program for children aged 4 to 7 years includes only a "major house." The model takes its inspiration from an apartment house. The coloured sections are the "apartments" while the white sections are the "elevators." When we take the elevator, we can only go to the next floor up or down. Hence, from the "D floor" to the "C floor," the "elevator" can move only downwards, which in the diagram is expressed by the tip of the corresponding triangle pointed downward (I use the relative names for the degrees on the scale; but in this case, this is not important).

These models get more complicated, become chromatic, and are no longer used as *sol-fa* diagrams, but as pictorial representation of a tonal system. The introduction of chromatic sounds is explained using the following picture (see Figure 3)

Figure 3

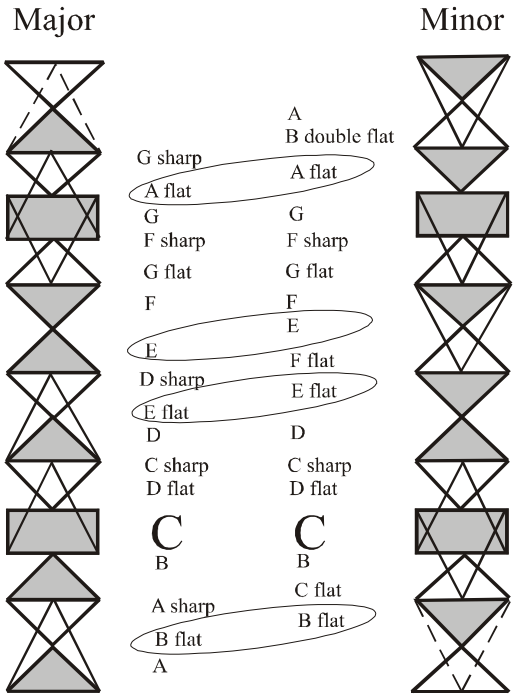

Figure 3.

In order to go in the opposite direction from C to D (upwards), you must take the proper elevator, designated as C sharp. Notice that in the diagram C sharp is higher that D flat (the top of the triangle symbolizes the chromatic degree, the centre of the triangle or the rectangle, the diatonic degree). The entire major model, and the minor one as well, comprises seventeen different notes for every key In the diagram, you can see the reciprocal symmetry of major and minor and the weight differences of each note. For example, E in C major is a diatonic degree; and therefore. its graphic position is in the centre of the triangle. The same E on the other hand in C minor is a chromatic degree, and hence is placed graphically at the top of the same triangle. These same 17 individual degrees will be found in the complete Lydian, Phrygian, etc. models.

2.

You can observe the same phenomenon in the Arab-Iranian musical system, in which these 17 notes are used without any uniform (equal) temperament. If we wish to work out similar graphic models for all six natural authentic scales (excluding the Hypophrygian, which is plagal), and we represent all of them at once on the same diagram, we will obtain (without considering the repeated degrees) a system composed of 22 different notes, identical to the Indian system. The tonic C influences the following series (see Figure 4):

C-Db-C#-Ebb-D-Eb-D#-Fb-E-F-E#-Db-F#-G-Ab-G#-Hbb-A-Bb-A#-Cb-B

Figure 4

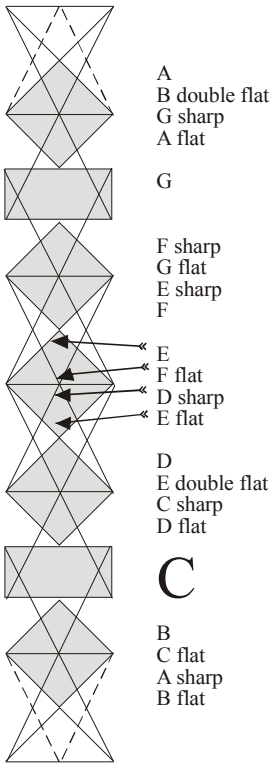

Figure 4.

It is clear that this model, elaborated in all the scales, would give a system of notes that is inordinately complicated and confusing. However, temperament simplifies the situation, as we all know. What then should a temperament be like if it is to make possible the use of all the 22 different notes of every scale? A necessary and sufficient condition for the problem would be a 29-tone equal temperament. Alexey Ogolevets (1941) suggested a similar idea. How would the piano keyboard appear with 29 notes? (See Figure 5).

Figure 5

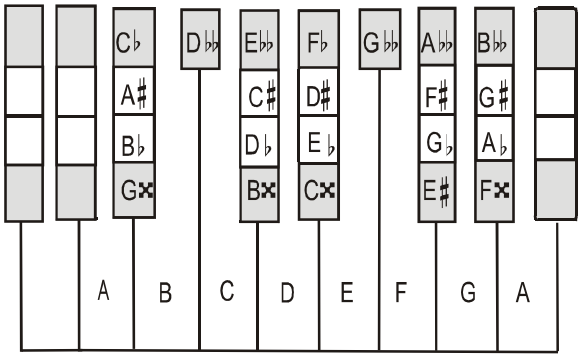

Figure 5.

We have posed the problem of creating a musical system that is not strictly European but universal, which logically encompass all the systems that are actually manifest in diverse musical cultures. The 29-tone equal temperament encompasses the pentatonic, the heptatonic, the European chromatic, the Arab-Iranian system, and the Indian system "sruti." Also, a keyboard instrument having a 29-tone temperament could be an excellent support for teaching, both in harmonic-tonal ear training as well as for microchromatic ear training. The microchromatic systems, which exist in the composition practice, are built from structural amorphous, artificial material, from evenly subdivided halftones (e.g. Alois Haba). A system, which consists of equal connections of his elements, is grammatically amorphous. The 12-tone equal temperament has grammatical meaning for us only because it is interpreted in our subconsciousness in a system of two different elements: the diatonic and the chromatic halftones. We don't have such an interpretation, for example, for quartertones, because it was not provided from the passed music culture (Curwen, 1858).

The author of this paper built, in 1977 in Moscow, a guitar with a 29-tone temperament solely for the purpose of convincing himself that these ideas are valid. With help of this instrument, ten-year old children could differentiate and precisely name 17 degrees in an octave. When attempting to work on ear training, however, the guitar may not be the most suitable instrument. Today, with the aid of electronics, intentions of this type can be actuated quite easily. On July 27th, 2003, I received from Dr. Peter Trubinov a computer program created by him that allows tuning any electronic keyboard into various equal temperaments (including 29-temperament).

3.

I would like to put forward a few things about the problem of the "coloured" ear and its possibilities of development. It is well known that the phenomenon of synesthesia is not uncommon. Regarding the coloured ear of Rimsky-Korsakov, we know something from the Yastrebtsev's (1908) testimonials. Also, Sabanejew (1911) published a table of Skriabin's "colour-sound" correspondences.

Despite the entire apparent casualty that occurs in the matching up of tone and colour, the sensations of Skriabin and Rimsky-Korsakov agree with each other. Both composers perceived in colour, not so much single sounds as tonal scales. For example, in the major scales with flats, the cold colours, meaning those colours that are located in the blue section of the spectrum, were prevalent for both composers while the scales having sharps were associated with warm colours. Naturally however, we are speaking only of tendencies, and exceptions do exist. I am proceeding from the assumption that, in their perception of coloured

scales, the composers express the structure of the piano keyboard with C major in the central position. We can represent C major as the super-tonic in a system of tonal relationships in which the other scales are situated at the greater or smaller distance from C major. The nearest scales are located at intervals of a fifth, a fact, which corresponds to the greater proximity of fifth-interval sounds (the slightest interference of sound waves in resonance). The first ones who have written about the dependence of the merging of the sounds making up an interval on the correlation of the frequencies were Strumpf (1890) and Helmholtz (1896), who counted the theoretical oscillations, something that was proven experimentally later on. (Taken rigorously, the greatest proximity between notes is in the octave and not in the fifth; however, the octave does not generate any new function).

When disucussing colours that are near to one another, we are referring to those that are next to each other in the spectrum (rainbow). Let us represent a spectrum of 12 colours, which should correspond to the circle of fifths from D flat to F sharp (see Table 1).

Table 1.

Violet	D flat
Blue-violet	A flat
Blue	E flat
Light blue	B flat
Aquamarine, blue-green	F
Green	C
Yellow-green	G
Lemon yellow	D
Yellow	A
Orange	E
Red	B
Scarlet, fire-engine red	F sharp

This coloured chain is condensed into chromatic scale (see Figure 6).

Figure 6

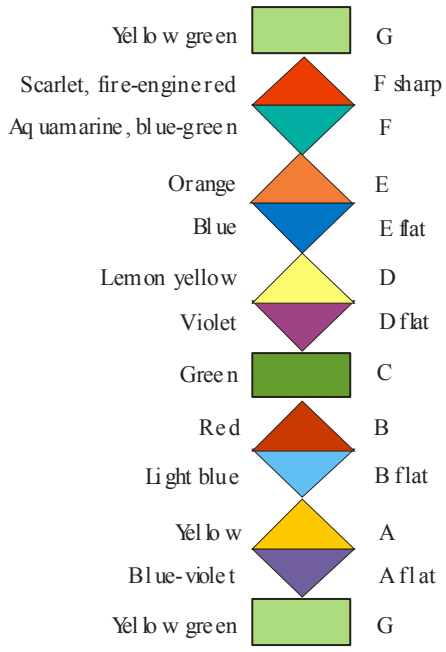

Figure 6.

We intend to devote our attention to the circumstance whereby C corresponds here to the colour green. The characteristic of the colour green is that it produces, as psychologists tell us, a sense of repose. The very same characteristic is to be attributed to the main tonic in the process of modulation and to the tonic in a non-modulating passage. Considering the scales primarily as a series of degrees, we obtain a relative sound-colour system.

For my purposes, I use 12 colours. After several years in which children have uninterrupted contact with coloured representations of a musical system, they begin to have relative associations as regards the "coloured" ear. However, are such associations really necessary? Don't they lead the perception of music outside of the musical field itself?

4.

The phenomenon of Synesthesia – the associations made among different sense organs – does not pertain solely to the connection between sound and colour. Guido d'Arezzo's idea about the link-up between sounds and the different parts of the palm of the hand appears, at first glance, to be solely indicative. This is not true. The area of the cerebral cortex, which is responsible for the signals that depart from the hand, occupy a disproportionately large part of the area of the human brain that is delegated to movement. Furthermore, we know from the practice of Chinese acupuncture that on the palm of the hand there actually are points corresponding to the ear. As in the case of the "Guidonian hand", the question touches upon the formation of

determined reflex connections between auditory sensations and tactile ones.

The gestures of John Curwen (1858) also belong to a similar kind. It is just that here we are looking at the connection between motor sensations and auditory ones. Also, the very same idea of *sol-fa* with conventional syllables pursues this purpose, that is, to actuate a connection between articulatory sensations and auditory ones. The articulatory zone of the human cerebral cortex occupies a large part of the motor zone that is not comparable to the other ones (Nazaikinsky, 1967).

As for the names of the notes of the scale that form the basis of the relative system, we use those names proposed by the Estonian pedagogue Heino Kaljuste. Their point of departure is *do-re-mi-fa-sol-la-si* (compare: *yoh-leh-vee-nah-zoh-rah-tee*). The vowels of Kaljustian syllables are the same, but the consonants have been substituted with others. This came about in order to avoid the confusion caused in the former Soviet Union by the use of the Guidonian syllables as absolute names. Following Agnes Hundoegger (Tonic "do" Method), we end all the sharped notes with "ee" and all the flatted notes with "uh." The "forward" vowels (such as "ee") require more effort of the articulatory apparatus and are naturally connected with attractions of the tonal degrees that go upward ("dominanting"). The only minor second connection in the hexachordal Guidonian system, *mi-fa*, has turned out to be extraordinarily rich in potentiality ("Mi et fa sunt tota musica." – Guido d'Arezzo).

Most external information reaches us by means of visual analyzers. Of these analyzers, the perceptors of colour play an essential (emotional) role. The idea of an association consists in the fact that one part of the brain is sustained by another part. Which areas of the brain are to be considered dominant in a particular child cannot be determined in advance. Therefore, the best strategy is to enact in the child a process of intake that comes from many different directions. Of these associations, the one between colour and music are to be considered useful (Shchetynsky, 1993).

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