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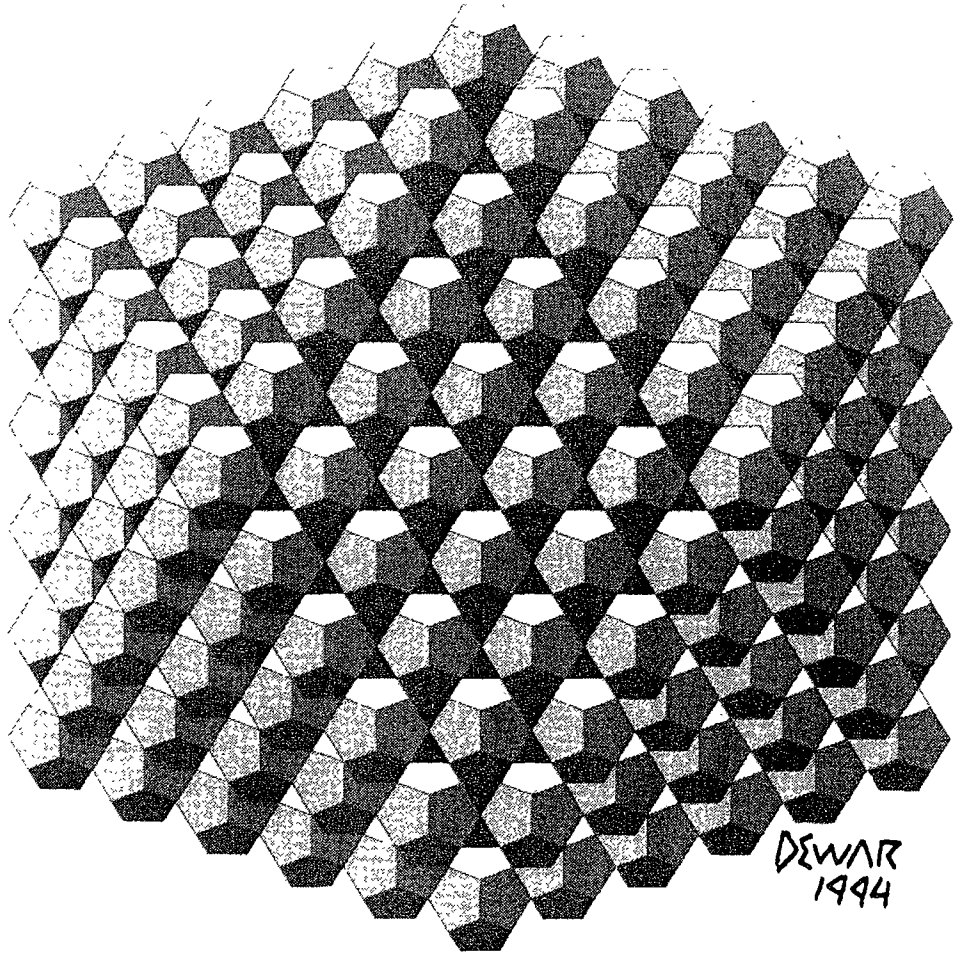

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PROPRIOCEPTIVE VS. VISUAL AND AUDITIVE SYMMETRY IN MUSIC

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Despite the current verdict that "music is the art of sound" music is in fact an art that is not only heard, but seen, and felt with the body as well. Thus the process of music, the tonal motions that are enacted in the imaginary musical room, can be frozen by means of notation symbols and appear on a piece of paper, where it can be studied synoptically, deprived of its driving force and its very medium of existence: the irreversible time. And along with, indeed on a par with, listening music can also be performed, implying that you control the music while you listen to it, and that you experience it with the sense of touch and especially with the sense of proprioception.

There are many symmetries in music that may be detected when you study scores, and symmetries do present themselves to the listener as well. Examples will be cited to show that visual symmetries do not always correspond to auditory ones (and the other way around) and that these two kinds of symmetries are of a quite different nature.

But the main subject of the paper is the proprioceptive symmetries that arise from the playing movements. These symmetries, coinciding with or overlapping with the visual and auditory ones as the case may be, are crucially dependent on the instrument played, the transposition (the key) of the music, and often also on the particular technical execution chosen by the musician for the passage in question.

To give an idea of this kind of symmetries and to study how they are correlated with seen and heard musical configurations, passages for piano, violin, guitar, flute, clarinet, trumpet, trombone, organ, marimba, and drum have been analyzed by professional players with respect to their inherent proprioceptive qualities. To indicate the scope of the problems involved the conditions of piano playing will be succinctly presented.

If you hold out your hands with, say, the back of the hands directed upwards, their symmetry is evident: the right hand is mirrored by the left, and both thumbs point inwards. But the piano keyboard, as we all know, has a non-symmetric, lateral layout with the bass notes to the left and the treble to the right. This clash between biologic symmetry and artificial lateralization causes much of the peculiar character of piano playing and several of its problems. If you want to play the same notated configuration with the left hand as you have just played with the right, you must reverse the finger sequence, and if you let one of your hands exactly imitate the actions of the other, you will hear something inverse and musically quite different. And as any accomplished pianist can tell, the fingering options are almost infinite.

But however excellent your technique is, the fingers are likely to retain something of their original and asymmetrically distributed peculiarities: the slow thumb having its own mode of working, the strong and nimble index and middle fingers, the not entirely independent ring-finger, and the little finger which is not only little but sometimes simply too short. And

while our hands look symmetric, they are not exactly alike from the neural point of view. Since most of us have dominant left brain hemispheres, our right hands are generally somewhat more alert, and this difference has in turn influenced the way keyboards are built and the way composers compose for the two hands. Human hands skilled at playing the piano, though still made of flesh and blood, are artefacts, shaped by the idiomatic properties of the piano literature and by years of practice.

Turning to the violin and the guitar, the hands have entirely different functions. The left hand is engaged in intonation along the neck of the instrument: higher pitches are played by moving to upper hand positions and by changing string. (These are tuned in perfect fifths and in perfect fourths/major third respectively.) Now the hand positions and the string changes can to a large extent be chosen by the player, and these choices therefore make up a pattern that covers the music structure in diverse ways. Using various finger combinations the guitarist's right hand plucks the strings, or strikes them with percussive up/down motions, while the violinist's right arm holds the bow and activates the strings with a carefully chosen sequence of up/down bowings giving rise to a second, and quite conspicuous patterning of the music.

Woodwind instruments work by means of a key system shortening the acoustically effective part of the pipe, and the two hands co-operate intimately to produce the pitches. The finger combinations are quite intricate, especially on the clarinet, and the same note may often be played in several different ways. The trumpet and the trombone are essentially played with the right hand, and the tube is lengthened to produce different notes by means of combinations of the three valves, and by drawing out the slide to seven positions, respectively: finger and arm movements that give rise to two further varieties of proprioceptive patterning imposed upon the music.

The organ pedals, the marimba, and the drum exemplify instruments played with right/left feet and hand alternation, respectively. In organ playing you can slide between the tip and the heel of the feet in order to accommodate for the shifts from upper to lower keys and to make the alternation scheme more flexible, and a similar use is made of the four sticks, two in each hand, when you play the marimba. The choice of alternation pattern and the relationship between alternations and rhythmic structure can finally be studied in two stick drum playing.

Proprioceptive symmetries in music are important for two reasons. They are likely to be intimately related to the technical units, the movement chunks, making up the musician's motor program, and presumably also integrated into the cognitive representation of the musical structure as it emerges for the musician. A study of such symmetries might therefore contribute both to more efficient teaching and learning strategies and to music analysis – music has seldom been described from the point of view of the players.