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The Changing Attitudes Toward Consonance and Dissonance In Various Historical Periods

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A Study
of
The Changing Attitudes Toward
Consonance and Dissonance
In Various Historical Periods

by

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INTRODUCTION

The problem of consonance and dissonance has intrigued and baffled theorists since the days of Pythagoras. There are many aspects of the problem which have never been satisfactorily explained. All are agreed, however, that consonances are those relations of pitch which can be expressed in small numbers. Why this should be so, no one has been able to decide definitely, at least up until Helmholtz[1] wrote his Sensations of Tone. It is also self-evident that consonance is a restful and dissonance a restless sound, that dissonance demands resolution into consonance and that the two are necessary to each other, in order that music may retain the variety and movement which makes it a vital art.

It is the purpose of this thesis to show that the acoustical truths as discovered by Pythagoras furnished a base for our musical system and that the five consonant intervals, the octave, fifth, fourth, third, and sixth were accepted by the human ear in the order of their prominence in the harmonic series whether incidental or

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[1] Helmholtz, Herman, Sensations of Tone, p. 229, answers the question which has defied theorists since Pythagoras as to why the amount of consonance is dependent upon the simplicity of the numerical ratio of an interval. "The ear," says Helmholtz, "resolves all complex sound into pendular oscillations, according to the laws of sympathetic vibrations, and that it regards as harmonious only such excitements of the nerves as continue without disturbance."

otherwise; and also to point out the attitudes toward and uses of these intervals as they appeared in the development from the sixth century B. C. to the very early part of the fourteenth century,---the time required to accomplish the apprenticeship period of music and furnish the materials with which the great masters Bach, Beethoven, Wagner and other composers could create a fuller and broader art. Also the subsequent appearing of seconds and wider use by modern composers of intervals previously considered dissonant will show an ever growing field of consonance.

The human ear has possessed the same physical capacity to accept sounds from the very earliest appearance of an interval in man's experience, but his powers of discernment have seemed to undergo an evolutionary process. While the ear remained the same structurally, the mind and attitudes in different periods have been conditioned by heredity and environment, which have hedged about musical experience with tradition and fashion. It is the intelligence of man which has raised him from the point of the savage where he was scarcely able to discriminate between sound and noise. Richard Walleschek has written an excellent book on Primitive Music in which he discusses the lack of discrimination of some of the savage tribes of Africa. The intelligence of the savage was not sufficiently developed for him to make use of the marvelous

mechanism of the ear.[2]

"Even animals recognize and utter intervals but cannot make any intelligent use of them, because they do not understand rhythmical arrangements."[3] The animal ear in many ways is superior to the human, but the animal lacks the mental capacity and judgement concerning intervals. And it was only as man rose in the scale of intelligence that his grasp of intervals became apparent.[4] This acceptance and use of intervals was a very gradual and evolutionary process and from time to time the idea of what was pleasing has varied greatly.

We shall endeavor to discover the reasons for this divergence between the acceptance of tonal combinations by the ear at different periods of music history. The state of mind regarding the interval must be taken into consideration. An interval viewed by a man of the sixth century B. C. would not arouse the same response from a man of the ninth century or the fourteenth century.

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[2]Hamilton, Clarence, in his Epochs in Musical Progress, p. 9 tells of this lack of a feeling for tonality in the music of the Omaha Indians where "a tune may end equally well on any tone of the scale".

[3]Wallaschek, Richard, Primitive Music, p. 233.

[4]Jeans, Sir James, Science and Music, pp. 163-4 speaks of some primitive tribes showing signs of an underlying tonality after advancing beyond homophonic music.

Habits of listening---wholly linear or partially harmonic attitudes---would play a large part in deciding what was satisfying.

We shall cite the uses of certain intervals by composers of different centuries. As can readily be seen, it will be possible to mention only a few of those composers who represent the culmination of years of growth. There are, of course, many more. The purpose of this thesis is to achieve a general and evolutionary view of the problem which precludes any exhaustive study of any one period. Probably the most worth-while aim will be to discover why these changing attitudes have existed and to find the underlying psychological laws which will explain the phenomena of consonance and dissonance in their relation to the emotions of man.

CHAPTER I

Acoustical Theories

The ear, so far as we know, has not changed structurally since the history of music began. In spite of all the vagaries and startlingly different types of music which man has enjoyed, his ear has never changed and--physically speaking--it has always been possible for man to receive all the sounds of which he is capable at present or will be capable of receiving a thousand years hence. Long before music existed as an art, or man began to produce and enjoy pleasant sounds, the harmonic basis of the music which he would enjoy was fixed for him in advance by the "mechanical and nervous structure of his organs of hearing."[1] However, this statement is not meant to infer limited possibilities but rather that the pattern for development was a preordained and orderly one and especially that any failure to perceive harmonic relationships was not because of any physical lack but lay solely with the barriers of conditioning and tradition.

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[1]Beatty, R., Hearing In Man And Animals, p. 175.

The fact that tonal combinations with ratios of small numbers are more perfect and pleasing has always existed as an acoustical truth. But primitive man did not combine tones except in octaves and this great truth was of little use to him. Consecutive fifths were once thought to be the height of musical composition (organum) but for the past several hundred years they have been banned. The ear that approved the consecutive fifths in the ninth century was, figuratively speaking, the same ear which is irked by it now, but the tonal environment and listening habits of a ninth century man and a concert goer in Carnegie Hall today are totally different. In the days of polyphony man listened in a linear manner. When the school of polyphony began to wane he changed his listening habits and entered on a period of vertical listening.

We find then that the "whole development of music, has not changed the human ear in any way."[2] and that those sounds are most pleasing to the ear "to which the ear has adapted itself through long association with them as its auditory environment...the principle which, it is believed underlies harmonic phenomena."[3]

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[2]Walleschek, Richard, Primitive Music, p. 271.

[3]Redfield, John, Music, A Science and An Art, p. 72.

Complexity and Analyzing Qualities of the Ear

We will not go into the physical structure of the ear in this paper. Any good book on acoustics offers this information. Rather are we concerned with its function of measuring and classifying sounds. Of all of the sense organs, perhaps the ear is the most accurate. It sorts what it receives, classifies and measures exactly. It classifies invaribly the relationship of the octave as an orderly and fundamental one. It measures and concludes that the fifth and the fourth are pure intervals when their vibration ratios are 2:3 or 3:4 and that their purity is clouded when these proportions are not exact. The "unerring judgement in the aural measuring of the octave and the fifth, is accordingly just as natural to us as the body's sense of space."[4]

Those interested in the complex analyzing faculties of the ear would do well to read a chapter in Sir James Jeans' Science and Music called "Tones Created by the Ear". In it he tells how the ear adds tones to complete the harmony of those which it hears.[5] When the fourth, fifth and sixth harmonics are heard without the fundamental, the ear instantly adds the fundamental as well as other

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[4]Hindemith, Paul, The Craft of Musical Composition, Bk. I, p. 23.

[5]Jeans, Sir James, Science and Music, p. 237.

harmonics.[6] The great mathematical and dissecting powers of the ear as well as the strange phenomena[7] of its functioning are a profound study.

This power which the ear possesses to analyze complex sounds enables us to recognize kinship between certain tones. It is believed that this analytic mechanism[8] resides in the cochlea.[9] The fibers of corti are presumably of varying lengths and tension--therefore tuned to different rates of vibration. These corti are spoken of by Sabine as "a harp of several thousand strings."[10]

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[6]Huneker, James, Overtones, p. 55. Richard Strauss is supposed to have had an abnormal ear. "His is the most marvelous agglomeration of cortical cells that science has ever recorded. So acute are his powers of acoustical differentiation that he must hear, not alone tones beyond the base and the top of the normal scale unheard by ordinary humans, but he must also hear, or rather overhear, the vibratory waves from all individual sounds."

[7]Watt, Henry J., The Psychology of Sound, pp. 179-180, writes of the phenomenon of variance in binaural hearing. With many persons there is a difference of pitch between the two ears. G. Revesz, experimenting, found that "most persons of normal hearing show a difference between their ears, often amounting to a semitone."

[8]Beatty, R. T., Hearing In Man And Animals, p. 174.

[9]Watt, Henry J., The Psychology of Sound, p. 227, says "for delicacy and regularity of structure man's cochlea cannot compete with that of many animals. All that we can do cognitively and artistically with what we hear, must be done in spite of the roughness and restrictions of our receptory apparatus."

[10]Sabine, Wallace, Collected Papers On Acoustics, p. 108.

It is certain that the ear is the most accurate of the sense organs, that it is a highly complex mechanism, and that it undoubtedly sorts, classifies and adds tones to fill in the pattern of the music system which has evolved according to a fixed plan because of the unchanging structural mechanism of the ear.

The Harmonic Series[11]

When we hear the musical tone given forth by a string in vibration, we hear not a single pure tone but a composite including added simple tones called partials. From the vibration of the string as a whole we get the fundamental, but the string also vibrates in halves, thirds, fourths and so on, each time the string length giving a different sound in the proportions of 1, 1/2, 1/3 etc. These partials are strongest or most audible in the order of their sequence in the proportions mentioned above--the first partial with the ratio of 1:2 sounding an octave above the fundamental, the second partial with a ratio of 2:3 sounding a fifth above and so on ad finitum. Every musical tone, therefore, "is a chord--of a kind. This chord present in every musical tone is the Chord of Nature,

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[11]According to Yasser, A Theory of Evolving Tonality, p. 269. The Harmonic Series is defined as "Partial tones (harmonics, overtones) produced by a sounding body simultaneously with its fundamental tone (generator) and forming a series whose vibration ratios can be mathematically expressed by ordinary numbers as 1, 2, 3, 4, 5, 6 etc."

and the series of partials constituting it is the Harmonic Series."[12]

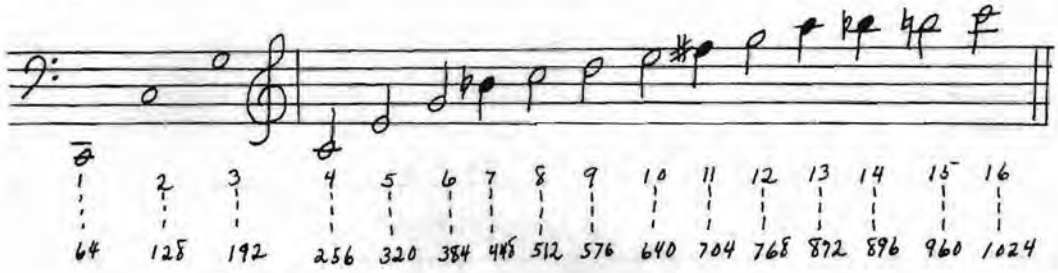

Fig. 37 The Harmonic Series

> "For practical uses, however, only a few of the harmonic partials need be considered. The first sixteen of these for the note C are shown in Fig. 37. The vibration numbers indicated beneath are calculated on the basis of the scientific pitch, which is somewhat lower than the international. Note also that the partials indicated by black notes are slightly out of tune with the corresponding tones in our scale."[13]

The phenomenon of the harmonics has long been known. The French writer Mersenne in his "Harmonic Universelle" published in 1636 regrets that Aristotle " 'seems to have been ignorant that every string produces five or more different sounds at the same instant.' "[14] Also in 1722 Rameau based his system of harmony chiefly on the harmonic series.[15]

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[12] Redfield, John, Music, A Science and An Art, p. 73.

[13] Hamilton, Clarence, Sound and Its Relation to Music, p. 56.

[14] Broadhouse, John, Musical Acoustics, pp. 130-131.

[15] Ibid., p. 131.

Theoretically speaking, the number of partials is infinite as the chord ascends, but practically , the higher partials are usually too weak to affect the ear at all. The lower partials, or the partials with the simplest ratios with the fundamental, are the consonances. The higher ones introduce more and more dissonance. The seventh harmonic "introduces an element of discord; if the fundamental note is c, 'its pitch is approximately $b^{b'}$", which forms a dissonance with c. The same is true of the ninth, eleventh, thirteenth, and all higher odd-numbered harmonics;"[16] Modernists rebel against this emphasis on these fundamental consonances of small ratios and advocate the use of other combinations of larger ratios, thereby enlarging the scope of consonances. Thus, the dissonant effect of modern music on the ear habitually accustomed to the purer consonances.

The historical acceptance of consonances has approximated the order of partials in the harmonic series. For a long period the octave (the fundamental and first overtone) was the only consonance to the primitive ear. Then the fifth was recognized which is the interval created by the next partial. The interval of the fourth appears and at last the third is acknowledged. The

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[16]Jeans, Sir James, Science and Music, p. 87.

seventh partial, B^b, of the fundamental C is not in accord with our theory of harmony. Perhaps it will be like the third. We may, in time to come, find some means by which we can accept this interval which at present is so dissonant to our ears.

There are two sides to this argument concerning the place of the harmonic series in the development of music. As just previously stated, the order of acceptance has followed almost exactly the order of the partials. Redfield gives two points in support of the harmonic theory.

> (1) "the relative strength of the partials in a musical tone has apparently determined the historical development of harmony; and (2) all the chords employed in well established harmonic practice are supplied by the partials of the harmonic series."[17]

One of the chief arguments of Helmholtz and others against the harmonic series as the basis of our music is the melodic character of early music. But according to Watt this evidence is not conclusive. He says that even primitive music involves a reference to consonance. In spite of the prevailing inability to find any such basis for the consonances of successive tones as is found for those of simultaneous tones in the fusion of tonal masses, it seems likely that the plea is a valid one."[18]

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[17] Redfield, John, Music, A Science and An Art, p. 77.

[18] Watt, Henry J., The Psychology of Sound, p. 113.

Yasser believes that even though harmony is not very evident in the music of certain peoples that it is nevertheless sensed by them in the depths of their being--perhaps in the form of vaguely stirring emotions and its laws, so far unformulated, are at work in the music". He believes that the scales of such peoples are formed first and that later the laws of harmony rise to the "surface of consciousness" after lying dormant in the structure of the music during the establishment of the scale.[19] Cecil Gray argues that harmony has always existed and that it is a "mere absurdity to imagine that it was invented by some nameless medieval monk. The Greeks always recognized its existence without ever employing it in our modern explicit sense, conceiving it rather as a law governing the succession of notes and determining the course of the melody;"[20]

The Russian writer Kryzhanovsky in support of his theory of the evolution of music states:

> The ulterior course of evolution is indicated in the system of overtones....Thus the European ear has comprehended the bases of tone, has instinctively guessed its structure, and has created its own tonal system in accordance with the example set by nature herself.[21]

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[19]Yasser, Joseph, A Theory of Evolving Tonality, p. 62.

[20]Gray, Cecil, A Survey of Contemporary Music, p. 138.

[21]Kryzhanovsky, Ivan, The Biological Bases of the Evolution of Music, p. 52.

Henry Cowell also joins the list of believers in the importance of the harmonic series. He says that "comparatively few know how closely the history of harmony has followed the series of natural overtones."[22]

Assuming that the harmonic series is the basis of harmonic development, the following facts are true. Most tones are complex. Each one has the partials in their order of intensity present and sounding in some degree. The accurate ear of man was unconsciously sorting and analyzing these tones before he consciously used them in music. The louder partials naturally were heard and felt more intensively and the upper partials were scarcely heard and consequently ignored. When the urge came to combine tones, man naturally turned to those which he had heard unconsciously for ages as partials of the single tones which he had used and heard. The first partials were most obvious to the neophyte in tonal combination, and he employed them in their order of prominence "when he desired to use intervals for their own sake, they naturally were in musical history in the order of their appearance (and loudness) in the harmonic series."[23]

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[22]Cowell, Henry, New Musical Resources, p. 3.

[23]Bartholomew, Wilmer, Acoustics of Music, p. 164.

Hindemith in his Craft of Musical Composition favors the law of the harmonic series and compares it with the principle of primary colors into which light may be divided.

> The eye perceives in light which has been split up by a prism, a natural series of vibration frequencies. The light of the sun always produces the same immutable series of colors familiar to us in the rainbow. Now, just as light consists of graduated colors of the spectrum, so a tone consists of many partial tones. The spectrum of the world of sound is the harmony or overtone series. A tone produced by a voice or instrument carries with it a greater or lesser number of barely audible overtones. Their order is not arbitrary; it is determined by a strict law, and is as immutable as the color series of the rainbow.[24]

Arguments against harmonic series as basis for historical acceptance.

Helmholtz is not of the opinion that the harmonic series had a great influence on our music. His reason is the melodic character of music that prevailed during much of the development of music. Man's musical thinking was of a linear character, argues Helmholz, and he "had no feeling at all for harmonic accompaniment."[25] There are oriental systems today and there existed some

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[24]Hindemith, Paul, The Craft of Musical Composition, Bk. I, p. 15.

[25]Helmholtz, Herman, Sensations of Tone, p. 253.

melodies in ancient times which scarcely admitted of any harmonic feeling.

Yasser infers that since music is an emotional art more than it is a rational one, that it is not primarily based on the harmonic series. If music were a rational art then it "is highly probable that it would be directly based, ... on the series of overtones, because the categorical imperative of rational musical thinking can only be an absolute acoustic exactitude (peculiar to this series), without the slightest deviation."[26]

Another modern writer, the psychologist, Henry Watt believes that the harmonic has little or nothing to do with the historical acceptance of intervals. Basing his opinion, like many others, on the lack of harmony as an "ingredient" in primitive music and also on the argument that only the consonance of the octave is based upon the coincidence of the upper partials, that in all other intervals "the innocence of the non-coincident partials must rest upon their mutual fusional relations."[27] Watt believes that thirds and sixths will always be most satisfactory, not because of any physical reason, but because of certain aesthetic and psychological characteristics."[28]

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[26]Yasser, Joseph, A Theory of Evolving Tonality, p. 236.

[27]Beatty, Richard, Hearing In Man And Animals, p. 128-9.

[28]Bartholomew, Wilmer, Acoustics of Music, p. 165.