

PHYSICS

Music May Have Scale Of 53 Notes, Predicts Jeans

Human Ear, Wearied With Old Harmonies, Demands New Notes at First Rejected, Then Tolerated, Liked

MUSICIANS of 1,000 years hence may be writing and playing their music on a scale which contains 53 notes to an octave, predicts Sir James Jeans, the noted British astronomer whose ability to turn scientific terms into the language of the layman has made the mysteries of the universe and the hearts of atoms enter the realm of non-fiction best sellers.

Sir James' newest book, "Science and Music" (Macmillan), predicts the 53-note scale for the distant future when all the possible combinations of the present 12 note scale have become boring to human ears.

But before that day comes, a day which will produce music better than the present, it may be expected that the music of the future will be like that of the present, but intensified. This has been the past history of music in which certain pleasing musical forms have been built up and persisted.

One tendency of music, says Sir James, has been the history of consecutive fifths. Harmonies which have seemed venturesome and even ugly to one generation seem natural and even beautiful to the next. And then through continuous use they become obvious and tedious to later generations. Just as popular swing music continually demands new "hit" tunes, so does "the sated ear forever demand new harmonies which it will fast learn to tolerate, and then dismiss as threadbare and uninteresting."

New Chords

Palestrina, J. S. Bach, Beethoven, Liszt, Wagner and Debussy are all examples of noted composers who broke new ground and introduced new chords that were considered discordant at first but which have now passed into the common language of music.

Sir James' scale of 53 notes enters in that distant day when it may be conceived that the human ear will find tolerable all the possible discordances which can be fashioned out of the present scale of 12 notes. In that day man will have only one other way to expand his musical horizon; by adding notes to the

scale and thus splitting the octave into more and more parts.

Already, says the British scientist, there has been some experimentation with quarter tones. Enlargement of the scale has been progressive throughout musical history, he adds. First there was the pentatonic scale with five notes, then the heptatonic scale with seven notes and finally the chromatic scale of the present with its 12 notes.

"Has it reached," asks Sir James, "its final resting place in the 12-interval division of the octave, or will the subdivision still continue?"

"We have already seen that the question is one for the arithmetician. Without forgetting the proverbial dangers of prophecy, we may be fairly sure that the laws of arithmetic will not alter, and that the natural harmonics will not change their position—a million years hence, as now, their frequencies will be 2, 3, 4, . . . times that of the fundamental. And, unless the physiological quality of our ears changes appreciably, we may assume that we shall always obtain our basic pleasure from chords whose frequency ratios can be expressed by the smallest of numbers. Because of this, it seems likely that the present fifth, with the simplest frequency ratio of all, 3 : 2, and the major third, with the next simplest frequency ratio 5 : 4, will figure largely in the music of the future. Before we attempt a conjecture about the musical scale of the future, it is worth seeing how far the subdivision of the octave would have to be extended, to provide a scale richer and purer in this respect than our present scale."

The logical divisions of the octave to obtain the maximum amount of harmonious fifths and major thirds occur at 12, 41, 53 and 306 notes to the octave. The 12 note octave is now being used and the 41 note octave has some difficulties, so that the next choice falls at 53 notes to a musical octave.

"So far as is known, a 53-note scale was first proposed by Gerardus Mercator (1512-94), the famous Flemish mathematician, geographer and map-maker. In the middle of the last century, two har-

moniums with 53 notes to the octave were built, one for Mr. R. H. M. Bosanquet of London, and one by Mr. J. P. White of Springfield, Mass., but neither seems to have been regarded as more than a curiosity," points out Sir James.

"We have already seen that the present 12-note scale has its roots embedded very deeply in the unalterable properties of numbers; we now find that music will have to go very far before finding a better scale. But a 53-note scale would give far purer harmonies than the present scale, and we can imagine future ages finding it worthy of adoption, in spite of all its added complexities—especially if mechanical devices replace human fingers in the performance of music. For, in the last resort, our limited scales have their origin in the limitations of our hands.

"Yet, if ever music becomes independent of the human hand, may not the race then elect to use a continuous scale in which every interval can be made perfect—as with the unaccompanied violin of today?"

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CHEMISTRY

Petroleum Chemists Told Of Need for Basic Research

RESearch in the chemistry of petroleum and its products has had to be rather higgledy-piggledy for a quarter of a century because the automobile industry has been a chronic Oliver Twist, holding out its dish and hungrily crying for "more." Research energies have had to be concentrated on meeting this terrific demand.

But now it is time to get down to real fundamentals of petroleum chemistry research, Dr. Harrison E. Howe, editor of Industrial and Engineering Chemistry, told the American Petroleum Institute. Thus far, petroleum chemists have been so busy as "oil cooks" that they have had time to find out the fundamental nature of only about ten per cent of the complex mixture that is crude oil. They need to work out the other ninety per cent of this basic knowledge, and then find out more about what the whole thing is good for.

"The petroleum industry owes its growth to research and the application of its results," Dr. Howe declared. "It must continue a research program, with adequate staffs of carefully-trained and chosen men giving their attention to expertly-chosen problems, if it would maintain its position."

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