NEW WAYS TO UN-TEMPER

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We had a discussion the other day concerning my ELASTIC TUNING organ and the article about it that I wrote recently, which has been circulated to a number of interested parties. In the course of explaining what "elastic tuning" means, the subject came up, "What about the logic-circuit invention of one Harold M. Waage several years ago, where he designed an automatic re-tuning system for electronic organs? — Does this come under the heading of Elastic Tuning also?"

No, it does <u>not</u>. Each of these separate systems conceived by different persons has its place, and both are now feasible with present-day technology.

Waage's system first: This is intended to get as close as practicable to just intonation with certain types of electronic organs without the organist having to play a conventional 18th-or 19th-century piece of music differently from the way one would perform the same piece in ordinary 12-tone equal temperament on that same organ. Why bother? you may ask. Because for the kind of music that Mr. Waage has in mind, it would gain in value if the restless beating of the twelve-tone-equal-tempered intervals in it were stilled, and with modern circuitry it becomes possible to effect this in a novel manner, which is the subject of his PatentNo. 4 152 964. (Some large libraries in certain cities have copies of patent specifications; while other libraries have the brief paragraphs of the U.S. Patent Office Official Gazette.)
Mr. Waage prepared a demonstration cassette where his invention is described and examples are played on an organ so equipped.

Brief summary: When a conventional chord is played on the specially-equipped electronic organ, an automatic scanner detects that the keys for this chord have been depressed. The master oscillators for those notes are influenced by re-tuning circuits which move the major or minor third or sixth in a triad to a just-intonation relation to the tonic. This flattens or sharpens the third or sixth in the chord to the just value, BEFORE that chord is heard. The error of the fourth or fifth in the chord in 12-tone equal temperament is so small (1/600 octave) that this is left alone—in practical musical performances it will not be detected by listeners. If we are dealing with seventh chords which would be smoothed by using the "harmonic" or "subminor" seventh in place of the standard conventional minor seventh, the logic circuitry will detect the seventh-chord pattern and flatten the seventh beyond the standard minor seventh and smooth that out, as would be done with the thirds. It makes no difference what key the chords are in; the logic circuitry accepts the pitch of the tonic as the norm and retunes the thirds and sixths (or the seventh in the case of a chord containing minor sevenths) to the just values.

Nearly all 19th-century standard church music for organ can be improved by this means, and will sound more restful when so performed. Much other conventional music performed on organs will also have a more restful, peaceful mood when the thirds and sixths are corrected. For this sort of music of the past, and for a certain portion of popular and folk music, Waage's scheme will work in most cases, and the special added circuitry can be turned on or off by the organist at their discretion.

Quite a number of early-model electronic organs will not work with Waage's invention, and quite a number of modern synthesizers will not work with it either. Enough organs that <u>will</u> work with it do exist, however, so the invention was worth the

trouble. The only objection is that it will not lead to any progress in xenharmonic music or to a system for extended just intonation under the direct control of a performer, nor to certain other just or nearly-just tuning-systems that today's composers need, in order to go beyond the prolonged stasis of the 19th century.

Therefore Mr. Waage's invention is for the conventional organist and choir, and useful to many people in barbershop quartets and other singing groups, and would have some use with string ensembles when they perform sustained slower music.

My Elastic-Tuning Organ was constructed in 1962 and I made quite a number of recordings on it; it was destroyed in moving in early 1985. Several persons during 1988 and 1989 who heard these recordwngs have become interested in pursuing the Elastic Tuning principle, among them John McBryde of El Cajon, CA.
→ A new demonstration Elastic Organ is planned.
We must explain the difference from Waage's invention right now before confusion takes over! This is urgent. Both for the success of Elastic Tuning instruments and for the success of organs designed to include Waage's self-justifying invention. Both systems have merit, but in DIFFERENT APPLICATIONS. Conceivably, one instrument could have both systems built in, but this is not likely. Also, both systems could be embodied in certain computer-music software, whether manually or computer-performed.

The biggest difference is that Elastic Tuning causes a MOVEMENT IN PITCH OF SOME OR ALL MEMBERS OF A CHORD TO BE HEARD WHILE THAT CHORD IS SOUNDING!

Waage's organ does not permit any movement of pitch to be heard, since the logic circuitry immediately SHIFTS or JUMPS some pitches BEFORE they are allowed to issue from the organ as sounds. The logic circuitry probably takes effect and does the abrupt shift from 12-tone-equal-tempered to just pitches in a thousandth of a second. Many computers do such things in a millionth of a second, so even that might be the case with Waage's apparatus.

I am quite sure of the above, since I have a copy of Waage's lecture/demonstration, and of course I have several of my own Elastic Tuning recordings which sound quite different. Each system has its proper use, I repeat.

Elastic Tuning represents a solution to the Equal and Unequal Temperament Problem that has been overlooked by instrument-inventors. It is based on what happens in a group of singers or certain instrumental ensembles such as strings, where the singers or players hear one another and ALL the performers adjust pitches to one another WHILE A CHORD IS SOUNDING. Not a question, as with Waage's organ, of scanning a chord before it has any chance to be heard 12-tone-tempered, and taking ONE note of this chord as FIXED and altering one or two other notes to fit it, and leaving the fourth or fifth alone because the 12-tone-temperament error is too small to matter.

In my Elastic Tuning organ it is quite otherwise! ALL the notes alter EACH OTHER and no one note in that chord may remain fixed. The singers in a chorus or the members of a string ensemble are of equal rank and no-one has the right to hold the pitch still and make the others be the only ones to move. The reason you are not too aware of their elastic-tuning process is simply that string-ensemble music, especially string quartets, goes too fast for any average listener to hear the mutual pitch-moving interaction as they affect each other and move to a consensus—before that has a chance to happen, usually the next chord is sounding! Also vibrato masks this effect.

In almost every organ, electronic or otherwise, pitches have been FIXED and do not alter each other because great pains have been taken to keep them ISOLATED so that they cannot influence one another as singers or string-players do. Up to now, the organ-tuner follows a strict tempering routine and sets the pitches; and the organist has absolutely nothing to say about it. With newer organs and synthesizers the pitches are usually fixed AT THE FACTORY and one can't even *call* in an organ-tuner. This total separation of organbuilder from organist, and in turn an even more distant and total separation of organist from composer, and thus <u>total</u> ignoring of all composers by manufacturers of organs and organ-like instruments, has thwarted any progress beyond the exhausted 12-tone equal temperament for over a century. The only possible chance to change things is for more composers to be also designers and preferably builders of instruments!

In order to construct an elastic-tuning organ, it is necessary to have the oscillators in the organ influence one another's pitches when and only when two or more notes are sounded together, and for each set of two or three or more notes sounded together, they will all retune to one another while the chord is sounding—that is to say, the initial tuning which us ally will be 12-tone equal temperament but can be just, or some other equal or unequal tuning such as 19-per-octave, WILL be fully heard at the moment the chord begins sounding and will be heard to MOVE toward just intonation or some smoother tuning ALL DURING THE SUSTAINING OF THIS CHORD, and then the NEXT chord will start in the initial tuning-condition and it will MOVE as all the notes in it retune themselves to one another--in effect holding an election and voting as to where they shall go. In many cases they will not REACH their goal. But the dynamic lively MOVEMENT TOWARD that goal WILL BE CLEARLY HEARD.

It is all the dif erence between dead and alive! No longer is this a totally-subjective idea of mine back in 1962-63: now enough people have heard the tapes to concur and to want to implement this elastic tuning principle in some manner.

Since 1962 - when I built that organ out of surplus and haphazard parts, there has been tremendous progress in the field of computer software. Mine was strictly a hardware design. I have conducted extensive discussion and correspondence in the last decade on this subject and have gotten mostly affirmative opinions that elastic tuning could be realized in computer software and furthermore that it could be made VARIABLE. While the discussion so far has been for altering an initial tuning of 12-tone-equal-temperament to just intonation, it would be quite possible to take other tunings and have them move by the Elastic Principle--even to go from initial just to some kind of temperament. In the case of the 1962 organ, it was put in 19- and 22-tone and 12-unequal and in a limited just array and in all those cases thee dynamic movement to justness while chords were sounding would take place.

In fairness we must also state that Harold Waage's system could be applied to an organ that was initially set oto 19- or 22-tone equal temperament or to meantone temperament in some form, and it would work just as well—by devising minor variations of his logic circuitry. Someone may wish to do that. No problem.

However: there is no use wasting your time trying to retrofit present commercial synthesizers or "canned music software" which is committed by the designers to 12-tone, to be elastic. It requires a new design from the beginning or the hardware being built or the computer program being written.

I am in an informal group called the Xenharmonic Music Alliance, which has grown over a 28-year period, and so can help others network with this group and hopefully carry on this effort after I am too old to continue. I am now 73.