

## **Making perfect just scales with wave-table synthesis**

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Wavetable synthesis of arbitrary frequencies requires interpolation between points in the wavetable. Interpolation is never perfect and is computationally expensive. However, synthesizing the frequencies of a just scale can be done without interpolation. Just scale frequencies based on three major triads having ratios 4:5:6 can be constructed where all frequencies are exact integers. The corresponding increments required to scan a wavetable are also exact integers. Hence, no interpolation is needed.

In addition, if the length of the wavetable is chosen so all the frequencies in the just scale exactly divide the wavetable length without remainders, then wavetable synthesis will generate a perfectly periodic function in which the same wavetable samples repeat each period.

I have synthesized such just scales and compared them both melodically and harmonically with equal tempered scales. I conclude from listening tests that for most musical purposes the scales are too perfect to be interesting. At least for music the scales would need to be used with great care.

Just and equal tempered frequencies differ by as much as 16 cents depending on the scale step. It is possible to synthesize an integer-equal-tempered-scale in which all wavetable increments are exact integers and hence no interpolation is required. The frequencies of this scale can be made to approximate an equal tempered scale much more closely than the equal tempered scale approximates a just scale. Whether this scale has musical importance remains to be seen.

In the talk I will synthesize and play examples of these scales.

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