

The Hayward Tuning Vine

an interface for Just Intonation

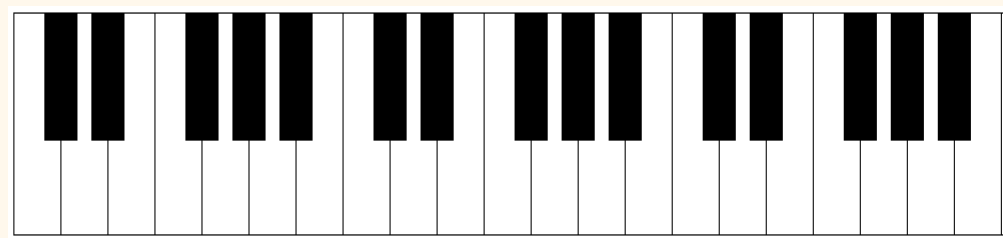


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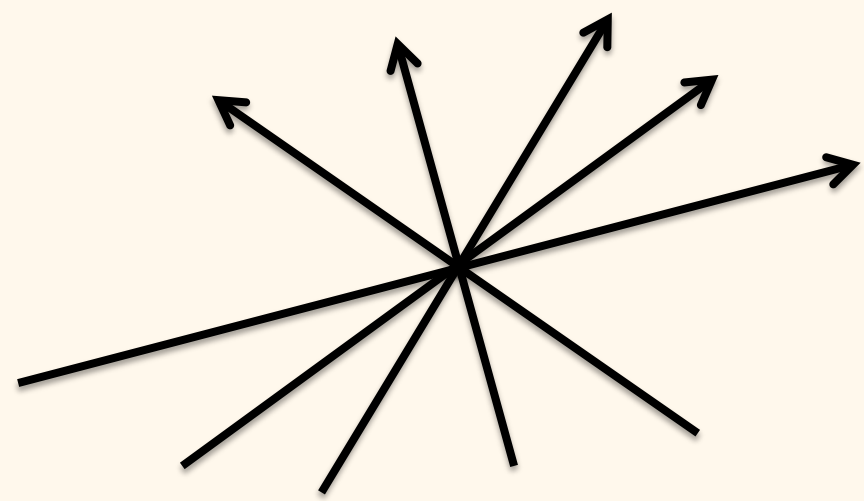
Introduction

The Hayward Tuning Vine is an audiovisual interface for exploring the system of microtonal tuning known as Just Intonation. It enables direct and intuitive interaction with the pitches normally hidden between the keys of the piano keyboard.

‘Tempered’ versus ‘Just’ tuning



In tempered tuning systems such as that normally found on the piano, the pitches are restricted to a single line, rising from low to high.



In contrast to this, the pitches contained within Just Intonation extend in multiple directions.

The harmonic lattice

Just Intonation is multidimensional because it is based on prime number relationships, with each prime number tracing a unique path in harmonic space [1].

● 1/1 (A440)

The central frequency in Just Intonation is absolute consonance, written as the ratio 1/1 (‘one to one’).

Any frequency may be defined as 1/1; in this case it is defined as A440 (the ‘A’ above middle ‘C’, vibrating at 440 Hz).

● 2/1 (A880)

● 1/1 (A440)

● 1/2 (A220)

Multiplying the central 1/1 frequency by prime number two results in the octave above it; dividing by two results in the octave below it.

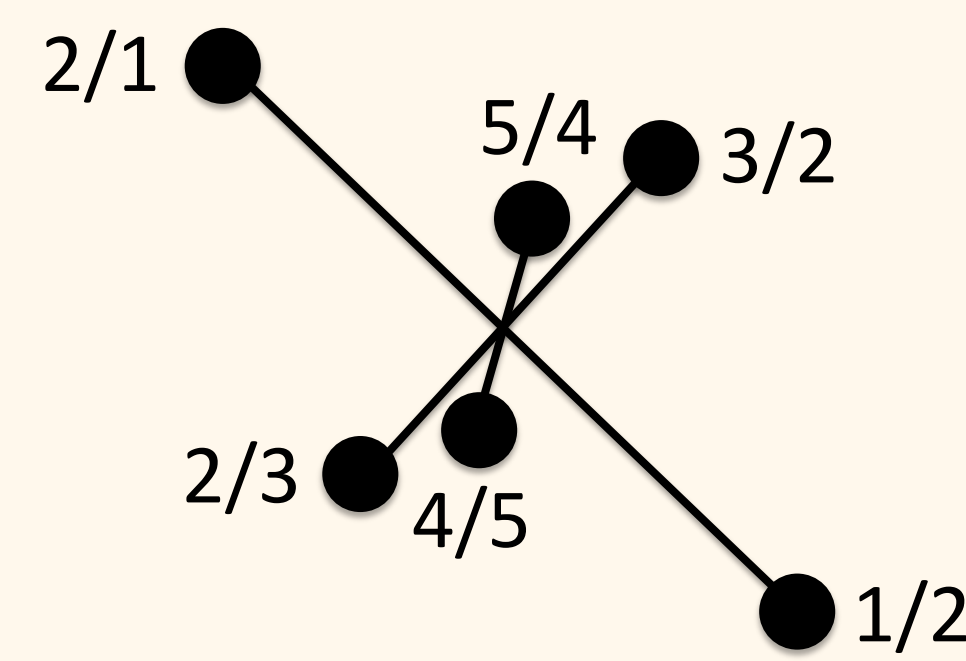
1/3 (D146.3) 1/1 (A440) 3/1 (E660)

Multiplying the 1/1 by prime number three raises it by an octave and a Just fifth; dividing by three lowers it by an octave and a Just fifth. A Just fifth is approximately two cents larger than a tempered fifth. A cent is defined as one hundredth of a tempered semitone.

5/1 (C# 2220) 1/5 (F88)

Multiplying by prime number five leads to two octaves and a Just major third above the 1/1; dividing by five to two octaves and a Just major third below it. A Just major third is roughly 14 cents smaller than a tempered major third.

Melodic pitch height



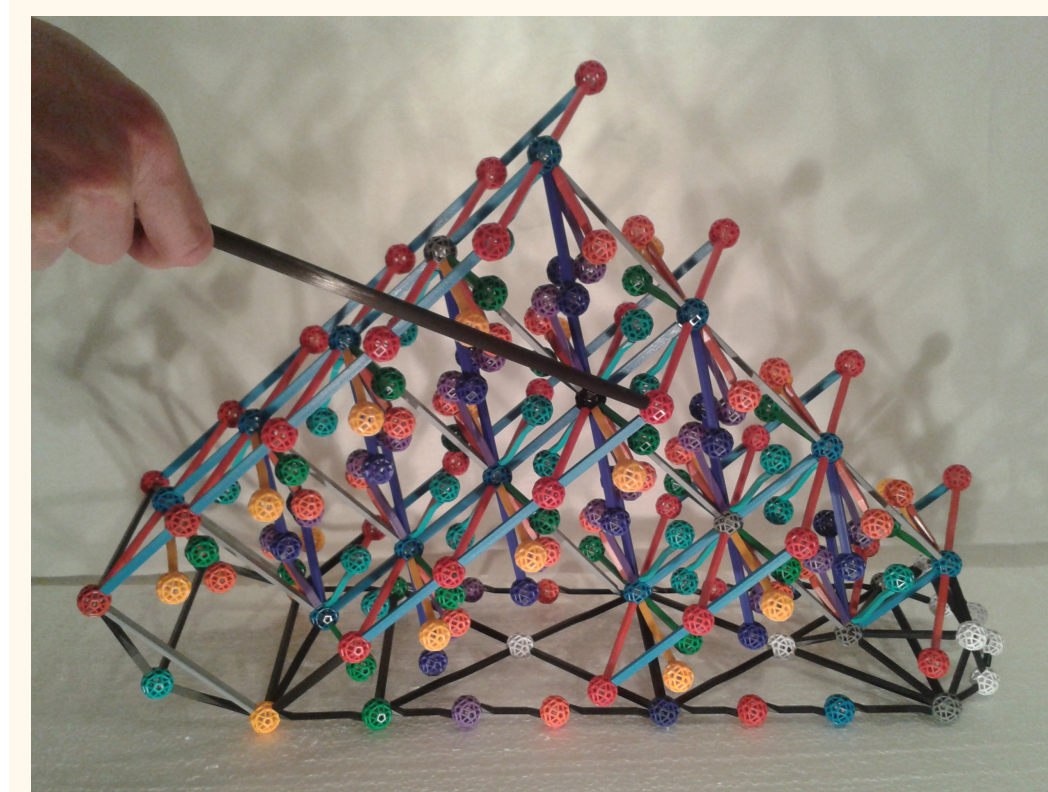
A key feature of the Tuning Vine is that melodic pitch height is aligned to vertical height within the lattice. This is achieved by transposing the intervals to within an octave, together with rotating the axes. Each prime number opens up a new category of musical intervals and is assigned a unique axis.

Higher prime numbers and colour-coding

- 1 black
- 2 grey
- 3 light blue
- 5 red
- 7 dark blue
- 11 orange
- 13 violet
- 17 green
- 19 yellow
- 23 turquoise

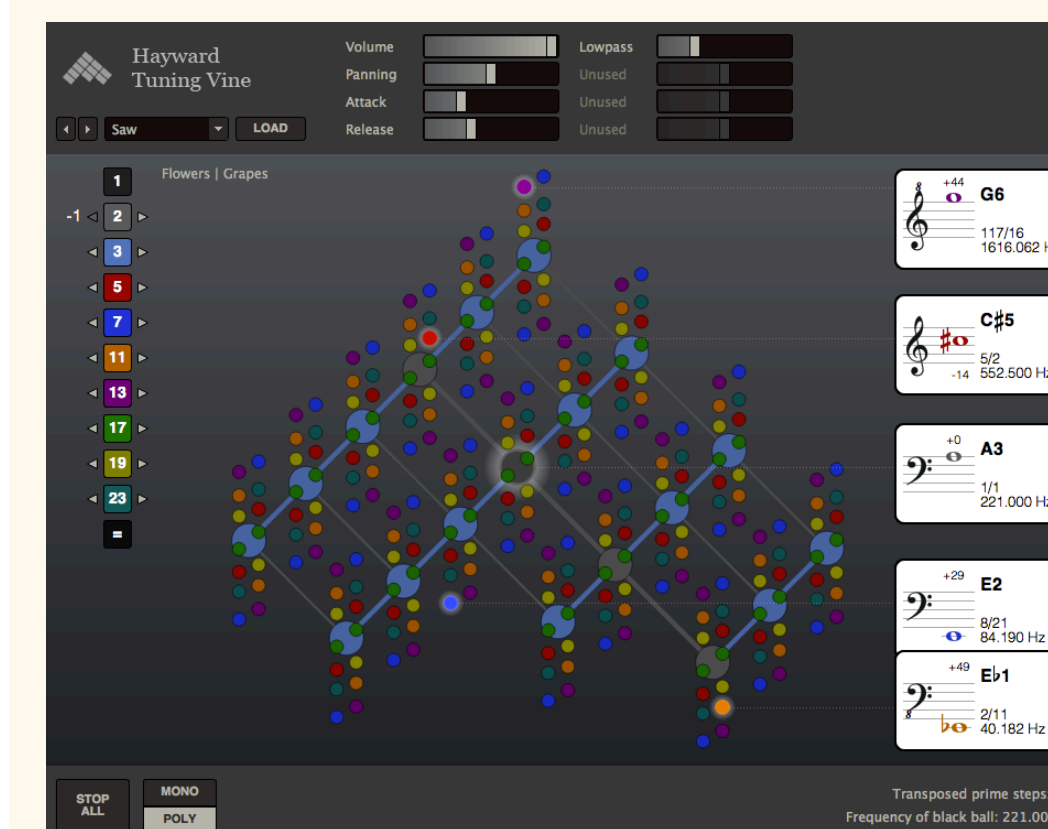
In order to maintain visual clarity, prime numbers are colour-coded in the Tuning Vine. Prime numbers above 23 are not included, as the microtonal identity of the corresponding musical intervals is barely audible.

Physical prototype of Tuning Vine



The physical prototype of the Tuning Vine was made with parts from the children’s toy Zometool [2]. Each ball is fitted with an RFID (radio frequency identification) tag, which may be triggered by an RFID ‘sound wand’ receiver.

Software version



In the software version [3], the balls light up when sounded and a card appears displaying the pitch’s notation, hertz number and cents deviation from tempered tuning. The number boxes to the left of the lattice allow the user to transpose independently along each prime number axis.

Chords may be built up in ‘poly’ mode, and melodies played in ‘mono’ mode. Under ‘options’, the central 1/1 may be set to any frequency. Along with standard wave forms, patches may be programmed in the free visual programming language Pure Data. Further parameters may then be adjusted independently for each pitch.

Conclusion

The current software version of the Tuning Vine goes a long way towards allowing direct interaction with Just Intonation. Along with software updates, App and hardware versions are planned to allow a greater degree of corporeal interaction. As it takes multidimensionality as its point of departure, the Hayward Tuning Vine could potentially become a standard interface for Just Intonation.

Contact

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References

- [1] J. Tenney. The Several Dimensions of Pitch. In C. Barlow (ed.), *The Ratio Book*, Feedback Studio Verlag, 2001, 102-115.
- [2] www.zometool.com
- [3] www.tuningvine.com