

Waves in Music – unifying the elements of pitch, rhythm, form, harmony and timbre. (Magazine Version)

written and illustrated by alwin tong

203 browning ave, Toronto, ON Canada

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Magazine Article (Waves as Music).

“dynamics, form, harmony, pitch, rhythm, tempo, texture, and timbre”

We as musicians are used to viewing music as consisting of melody, rhythm and timbre but some interesting things happen when we merely view music as consisting of waves.

The first thing we notice is that pitch and rhythm are not really separate at all. The two can be treated as identical, if we treat both as pure & simple oscillations. This is easily found to be true after some initial investigation.

We can for instance take any pitch and slow it down enough until each oscillation becomes a ‘beat’ in time, or any rhythm and speed it up until it becomes a pitch.

Here is A-440 taken down 5 octaves.

A – 440

A – 220

A – 110

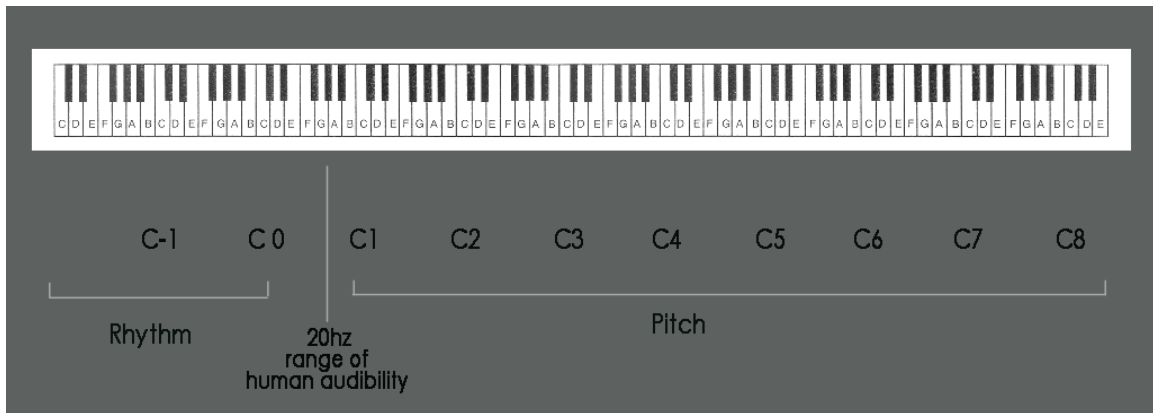
A – 55

A – 22.5

A – 11.25 (rhythm)

The note “a” then becomes a rhythm to our ears, from the fact that any oscillation below 20-40 hz passes the point of resolution, our ears are equipped to handle when dealing with pitch. It becomes rhythm after that.

(illustration 1.1 – picture of a piano with extended octaves below C1 (alla bosen-dorfer) where the a shows up.)



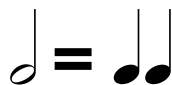
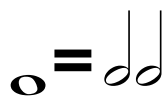
Similarly when we hear a fly floating around the room, what we are really hearing the beating of its wings, however it's of such a speed that we interpret it as pitch to our ears.

Thus from a wave-point of view the barrier between rhythm + pitch (melody) is not really one at all. It is not the reality which determines what we hear, but merely our biology.

Our eyes being another example of mother nature drawing a line, when infrared UV, radio or microwaves are used, they are simply colours which go undetected by our human eyes.

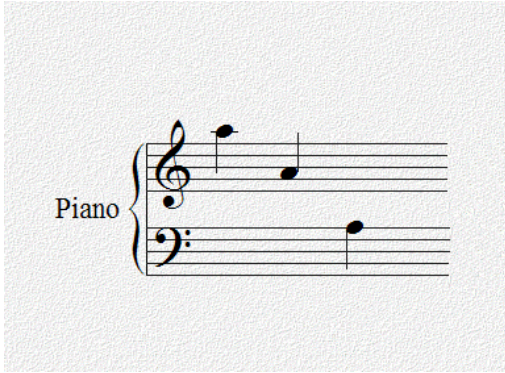
Because pitch and rhythm are identical from a wave perspective, certain trends will present themselves which otherwise might go unnoticed. For instance, according to the wave perspective, an octave can be indicated by either

(figure 1.2 – 4/4 time 2 half notes over whole note | 2 quarter over 1 half | 2 eighths over 1 quarter | 2 sixteenth over 1 eighth)





just as easily we can write

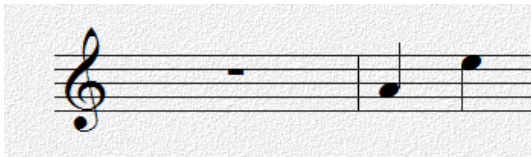


(figure 1.3 – grand staff with three octave span of A's)

as both span a 3 octave range.

Taking this relationship further, we see other intervals too have their representation in rhythm form.

A perfect fifth can be considered :



OR

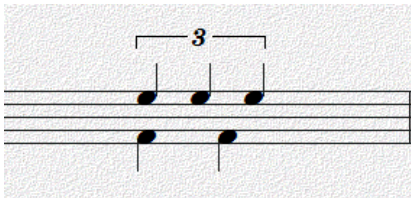


OR IT CAN BE



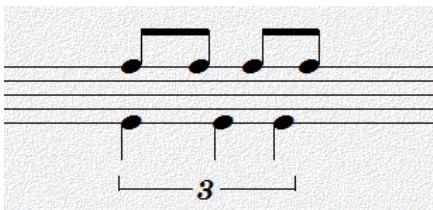
(figure 1.4 – grand staff with perfect fifth and then a 3 triplet eighths over 2 eighths)

or an octave lower it would the same intervals would be.



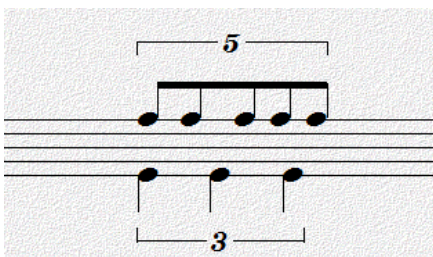
(figure 1.5 – octave lower of same fifths, and quarter-note triplets over half-notes)

A perfect fourth is



(fig. 1.6 - same as diagram above with corresponding interval)

A major third



(fig 1.7 - same as diagram above with corresponding interval)

Intervals in music being simply ratios between two frequencies, regardless of timescale; an octave is an octave, a third a third, a fifth a fifth etc. no matter which register we choose to view them.

Thus a picture emerges which might look like this

Oscillations

(low freq) RHYTHM (high freq) ----- (low freq) PITCH (high freq)

(figure 1.8 – EM spectrum with ---- Rhythm --- Pitch--)

Oscillations

(low freq) FORM (high freq) ----- (low freq) RHYTHM (high freq) ----- (low freq) PITCH (high freq)

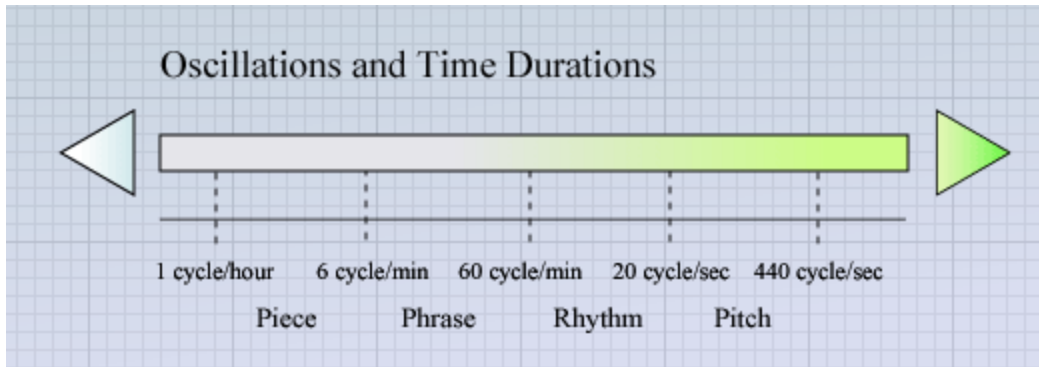
Extending this principle once again, its possible to view musical form similarly obeying the same patterns of oscillation, simply on a longer time scale.

Form as an oscillation is measured on the time scale of repeated phrases (microform) through to the grand oscillation of a piece beginning and ending (usually in the tonic, or some form of thematic material).

Almost all (if not all) pieces of music have this larger form of regular oscillation in them. From the oscillation through 4 movements of a symphony to the song cycle, theme/variations, 24/preludes and fugues, sonatas etc.

Take for instance the sonata form, which contains the key relationship of I – V – I (three parts) but also contains another organic division of 2 parts (ascension of tension to climax, decline of tension from climax). This dichotomy can be seen as emulating the 'overtones' of a harmonically rich oscillation, such as that of violin string, whereby vibrations of the string as a whole, half, thirds etc occur simultaneously.

From this wave perspective then, can we build a gradient of oscillation which begins at form, measured in minutes or hours and ending at its peak at 20,000 hz the limit of human audibility?



Remember the quote “music rhythm, timbre” from

Then what about the last musical element – timbre? To be explored in the next portion of the article.