

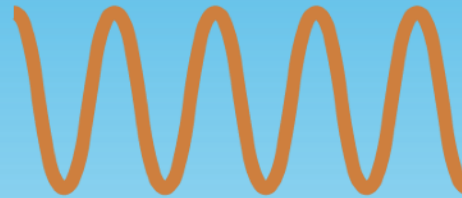
TOMMASO ROSATI
SOUND ART

SOUND2 FREQUENCY

SOURCE



WAVE



AUDITORY
SYSTEM



ELASTIC MEDIUM

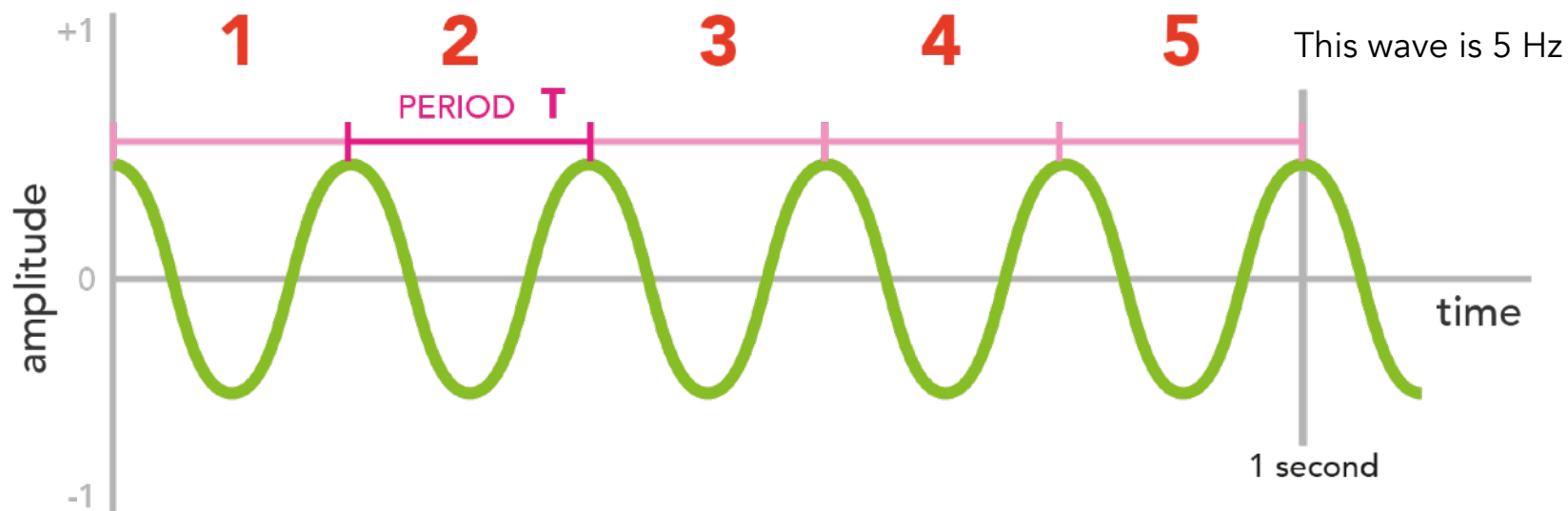


Frequency

It's the number of times a wave cycle repeats in one second and is expressed in Hertz (Hz)

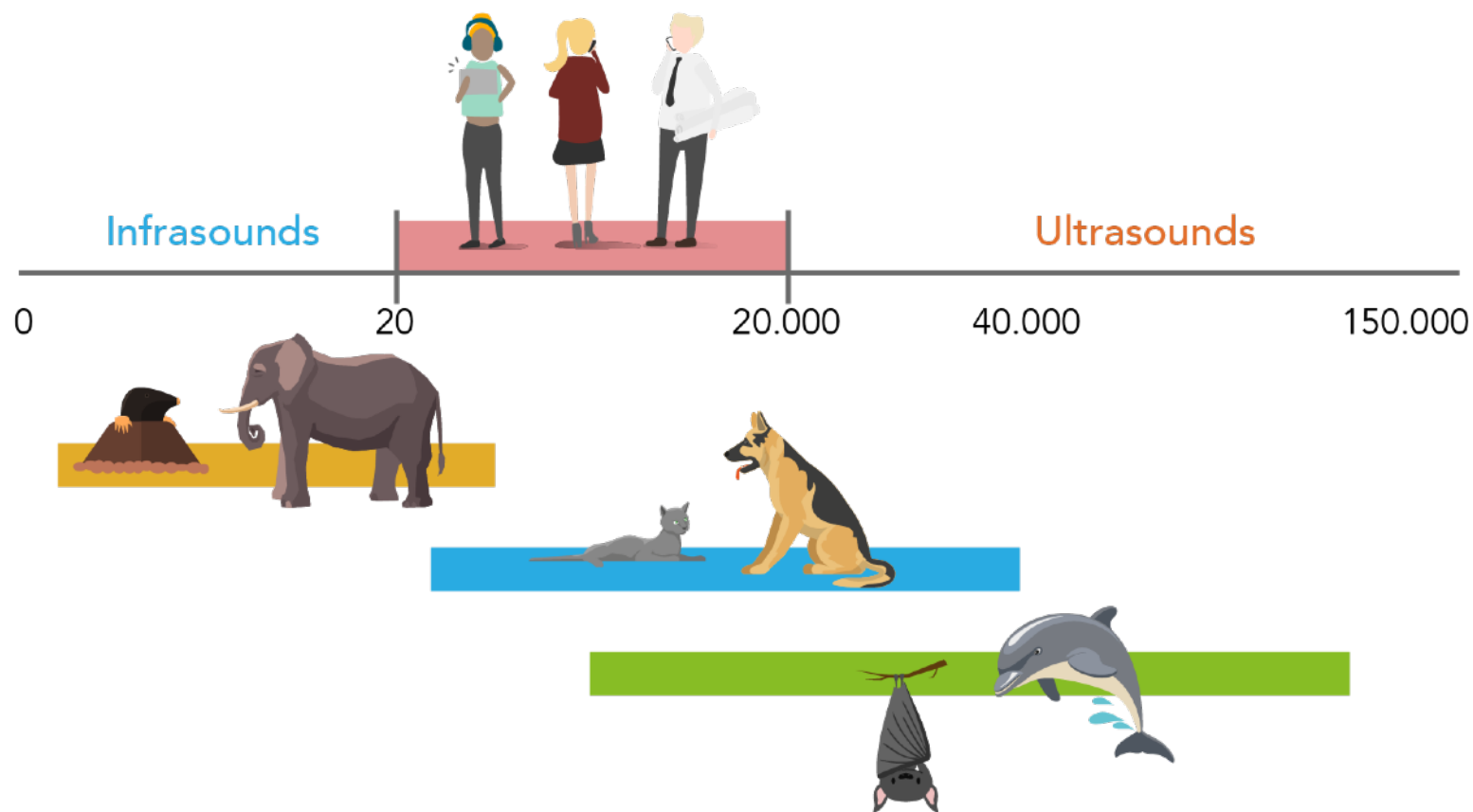
Frequency is the reciprocal of period, which in mathematical formulas is expressed:

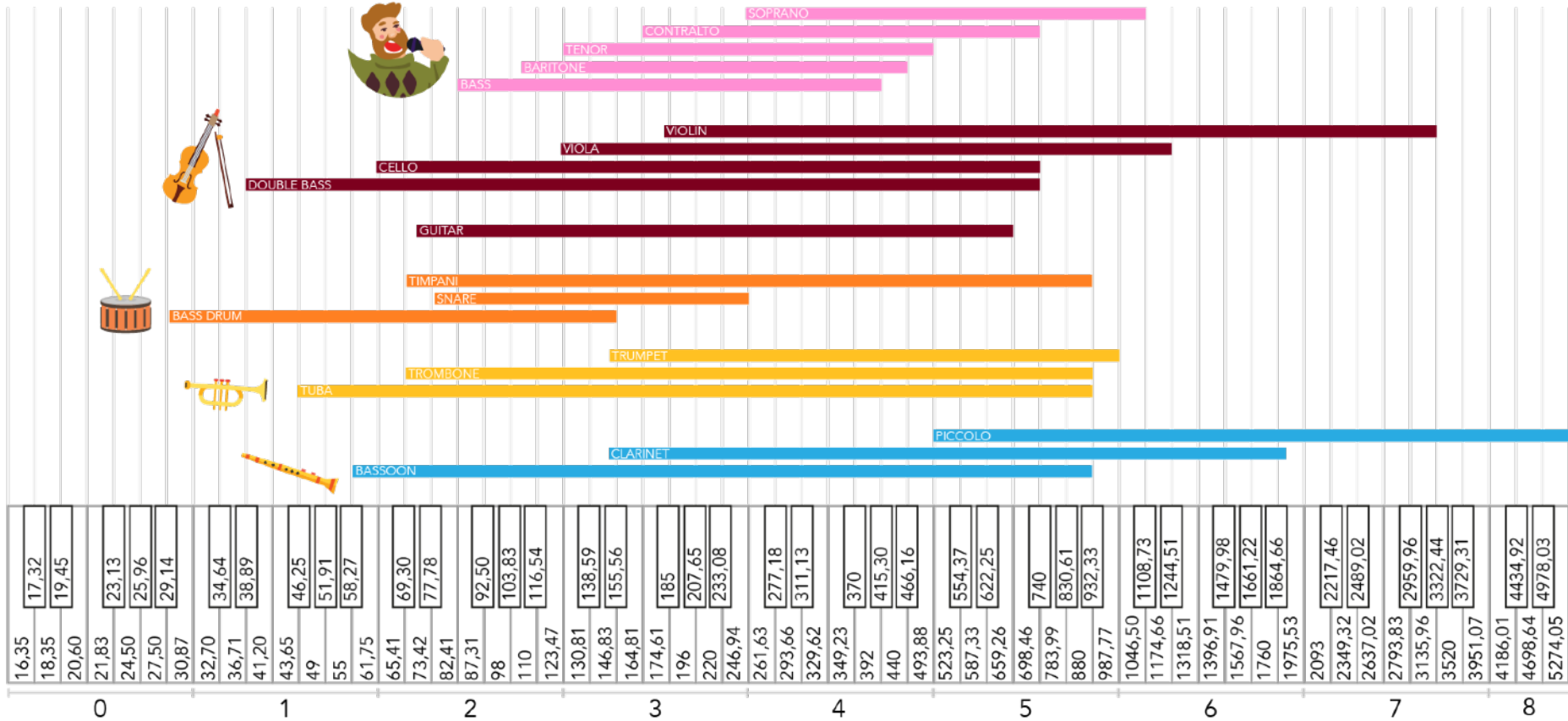
$$f = 1 / T \quad T = 1 / f$$



frequency **f** = $\frac{1}{T}$ stands for 1 second of time
wave period

Humans do not perceive all frequencies but only a range:
from 20 to 20.000 Hz





C1 = 32.70 Hz

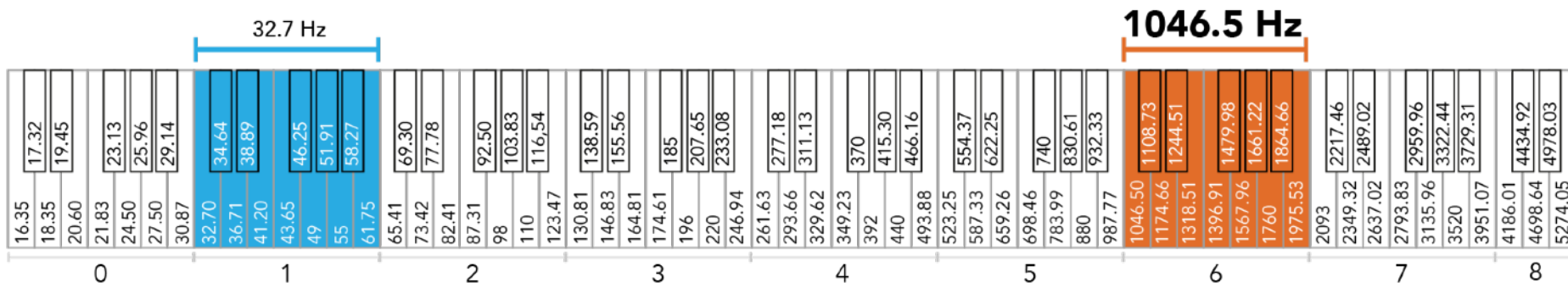
C2 = 65.41 Hz

The difference is **32.7 Hz**

C6 = 1046.50 Hz

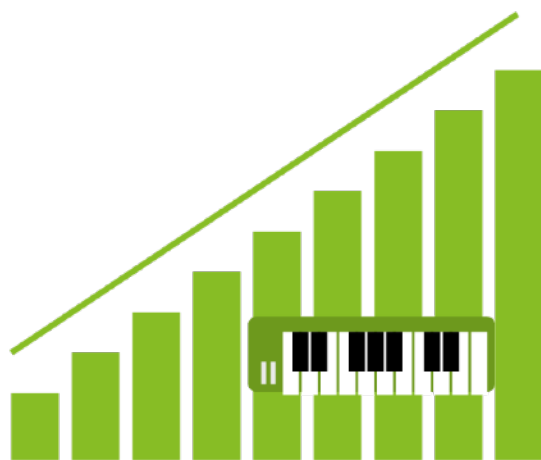
C7 = 2093.00 Hz

The difference is **1046.5 Hz**



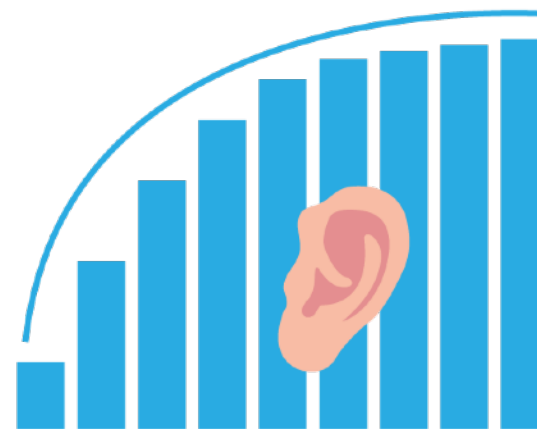
The measure of an octave and any other interval grows as frequency increases. Practically, the steps between notes that we perceive to be all the same correspond to changes in frequency that grow larger and larger. They follow an exponential trend (larger and larger steps) rather than a linear trend (steps that are all the same).

This is because the way semitones follow each other in our temperate system is in **steps that are all equal (LINEAR)**



Linear

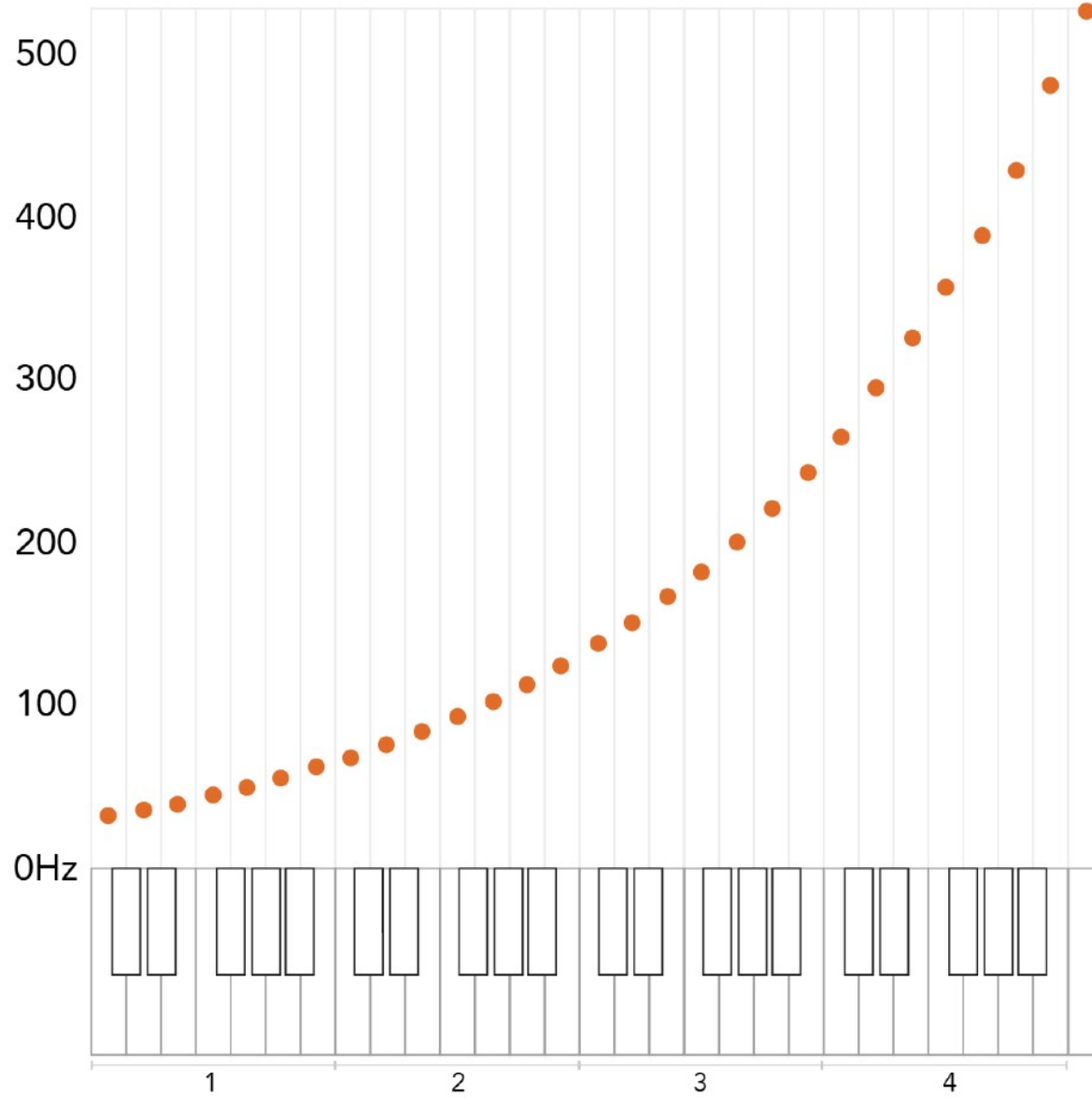
the way our auditory apparatus works regards to frequencies is in smaller and smaller steps (**NON LINEAR, LOGARITHMIC** type).



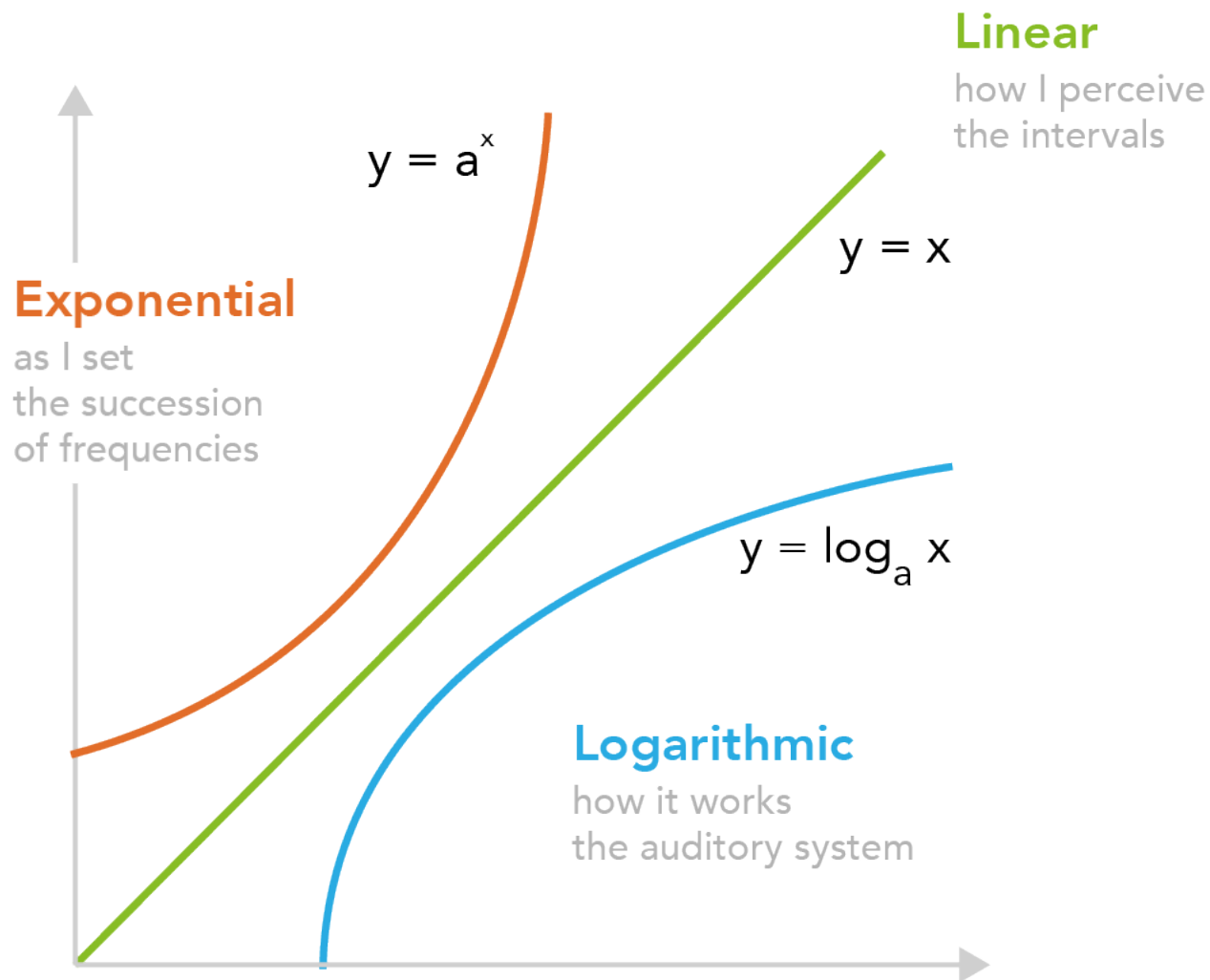
Logarithmic

I create a scale that is **exponential** (with larger and larger steps) to compensate for my hearing working logarithmically (with smaller and smaller steps) to perceive notes that have a linear pattern (with steps that are all the same).

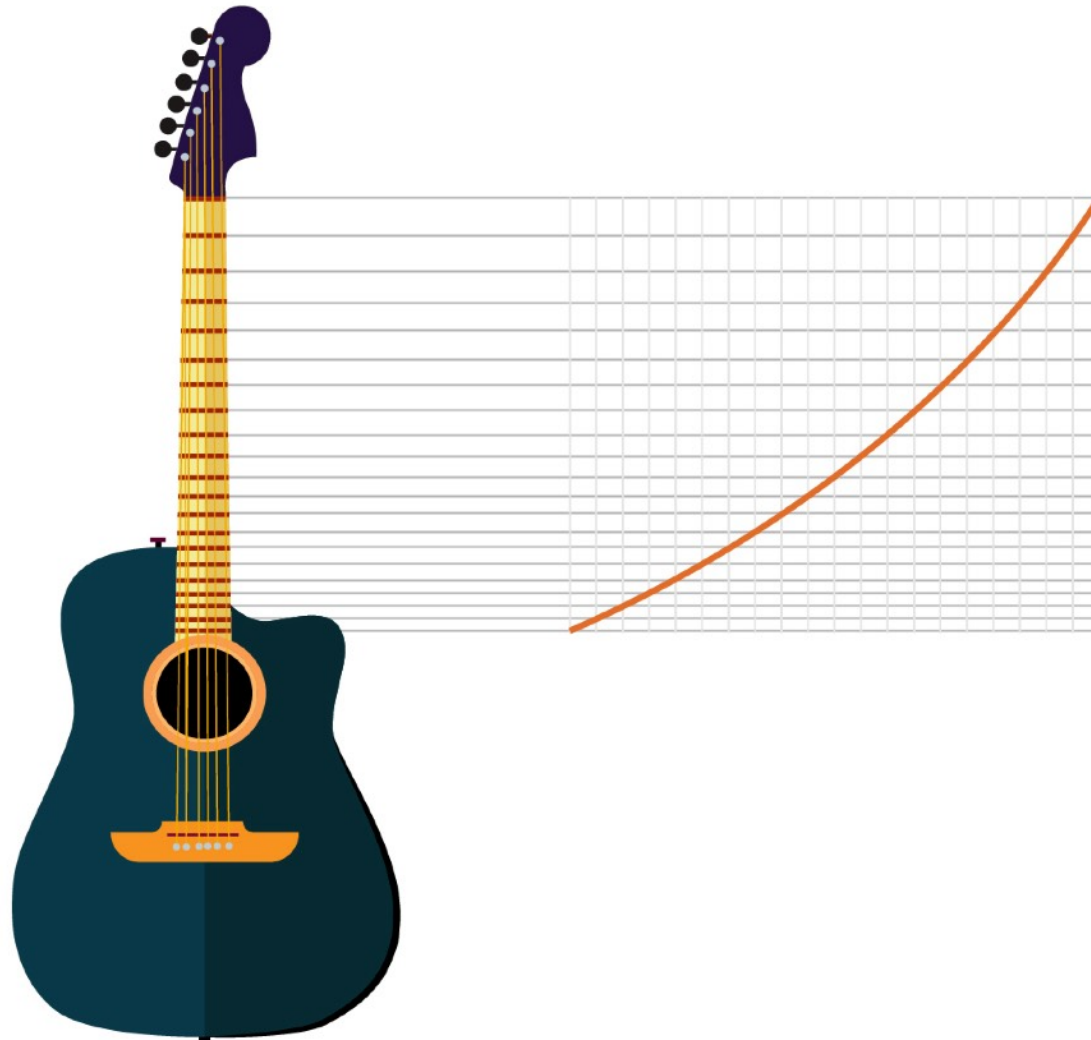




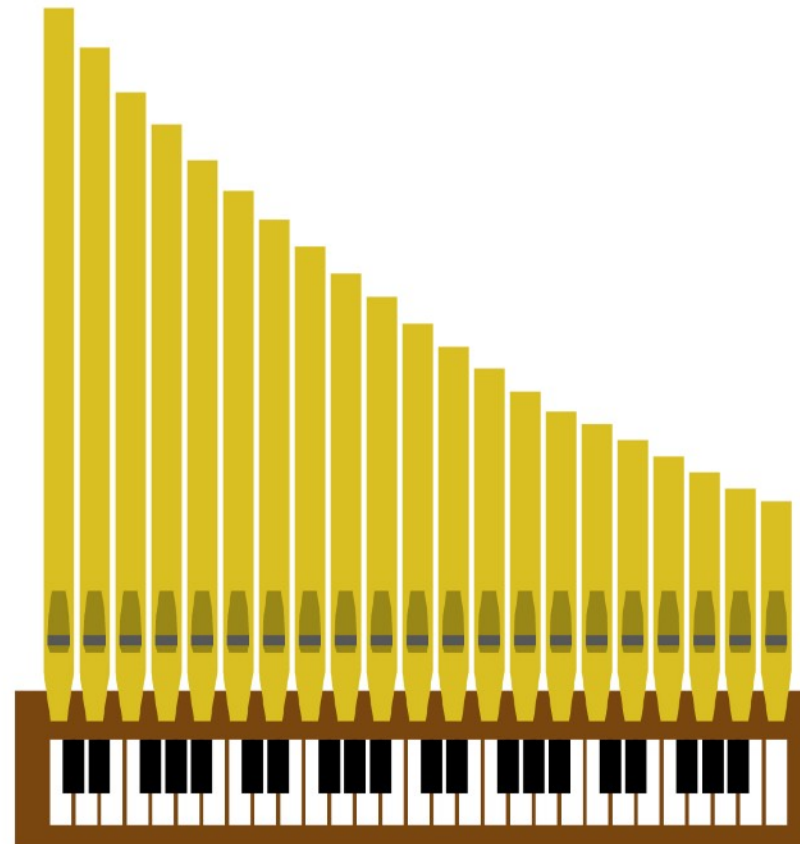
Equal temperament



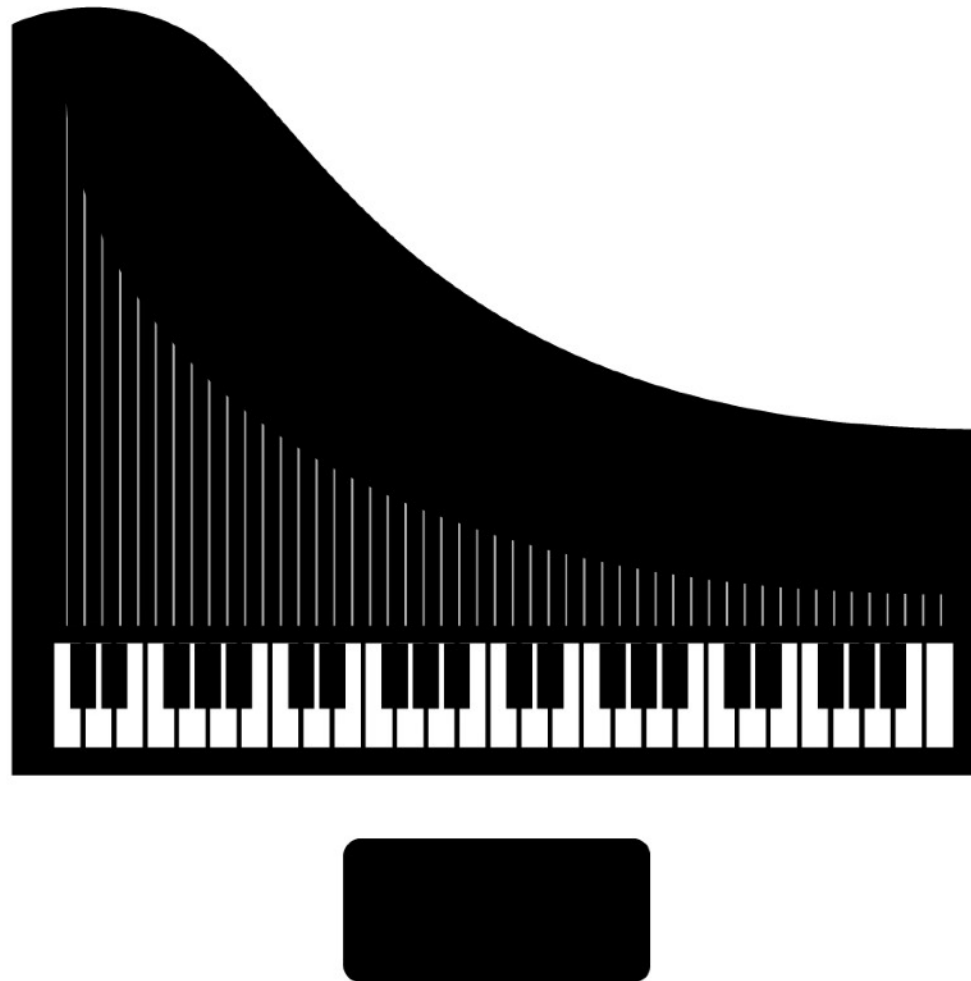
Guitar frets widths



Organ pipes length



Piano strings lengths



Equal temperament

How then is the frequency of a note calculated?

The ratio between the frequencies of two successive semitones is a constant value, r .

Given a base frequency f , to get the next semitone X I need only do: $f_n * r^x$.

$$r = \sqrt[12]{2} = 1.0594631\dots$$

$$C = 32.7$$

$$C\# = 32.7 * r$$

$$D = 32.7 * r * r = 32.7 * r^2$$

$$D\# = 32.7 * r * r * r = 32.7 * r^3$$

$$E = 32.7 * r * r * r * r = 32.7 * r^4$$

...

$$C2 = 32.7 * r^{12} = 32.7 * 2$$



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