# Consonance & Dissonance:

**Consonance:** A combination of two (or more) tones of different frequencies that results in a musically ***pleasing*** sound. Why???

**Dissonance:** A combination of two (or more) tones of different frequencies that results in a musically ***displeasing*** sound. Why???

⇒ *n.b.* Perception of sounds is also wired into (different of) our emotional centers!!! Why???/How did ***this*** happen???

The Greek scholar Pythagoras discovered & studied the phenomenon of consonance & dissonance, using an instrument called a ***monochord*** (see below) – a simple 1-stringed instrument with a movable bridge, dividing the string of length $L$ into two segments, $x$ and $L–x$. Thus, the two string segments can have any desired ratio, $R \equiv x/(L–x)$.

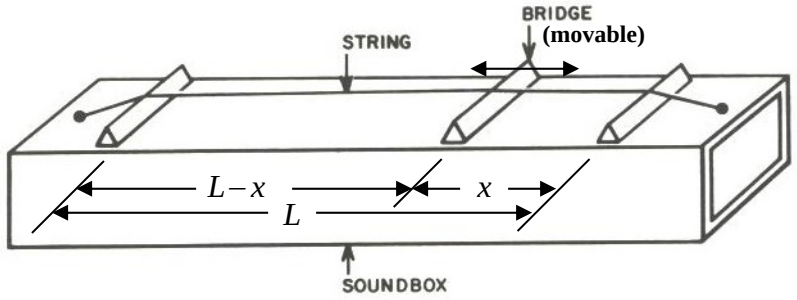


FIG. 1. The monochord.

When the monochord is played, both string segments vibrate simultaneously. Since the two segments of the string have a common tension, $T$, and the mass per unit length, $\mu = M/L$ is the same on both sides of the string, then the speed of propagation of waves on each of the two segments of the string is the same, $v = \sqrt{T/\mu}$, and therefore on the $x$-segment of string, the wavelength (of the fundamental) is $\lambda_x = 2x = v/f_x$ and on the $(L–x)$ segment of the string, we have $\lambda_{L-x} = 2(L–x) = v/f_{L-x}$. Thus, the two frequencies associated with the two vibrating string segments $x$ and $L – x$ on either side of the movable bridge are:

$$f_x = \frac{v}{2x}$$

$$f_{L-x} = \frac{v}{2(L-x)}$$