

Handbell Science

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Goals:

1. Learn something you can take back to your ringing experience
2. Creativity
3. Intentionally Ring Musically

Hypothesis/theory to prove today:

Understanding the science of this instrument gives us the knowledge to improve the musicality of each piece we play.

Lesson 1: Physics of handbell casting related to sound wave creation

<http://youtube.com/watch?v=JyP99r5xnuU> (high speed handbell)

Lesson 2: Attenuate the Sound (a.k.a. damping the handbell)

Attenuate – taking some or all the energy from the sound wave.

Lesson 3: Parts of a Wave

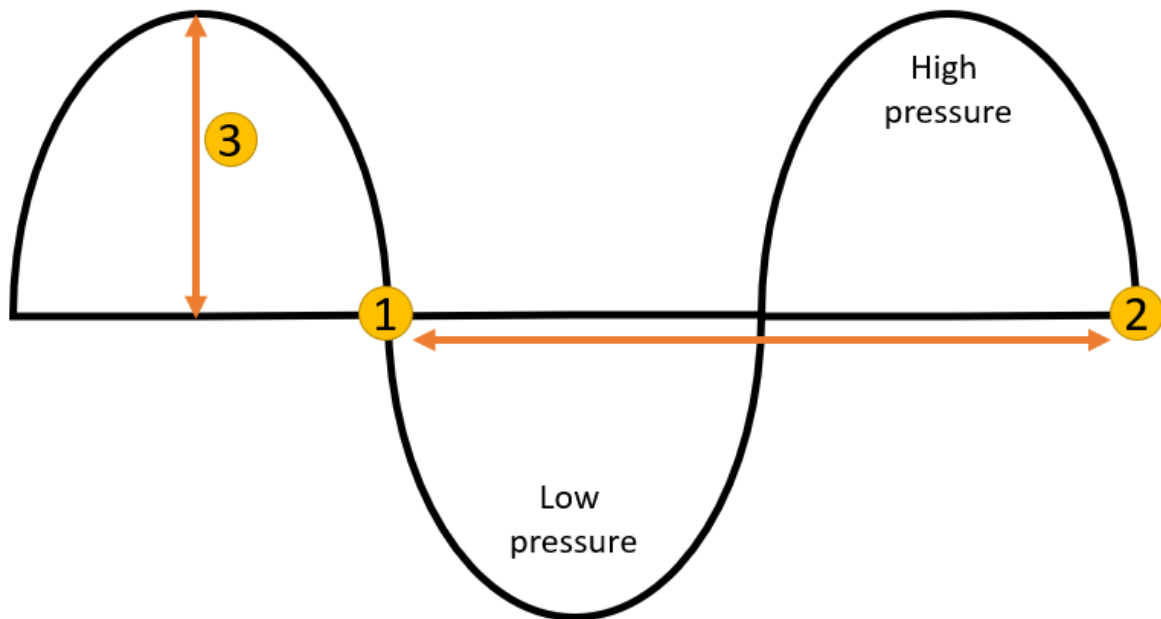


Diagram A: Parts of a wave

Wavelength is the distance between two identical parts, e.g. from crest to crest or trough to trough. (*Distance between point 1 & point 2 in diagram A – horizontal arrow.*)

Amplitude is the volume of height of the crest or trough. Amplitude is perceived by our ears as loudness. Casting material and wall thickness determines the maximum amplitude/loudness the bell can produce. (*Amplitude is represented by the vertical arrow (3) in diagram A.*)

Frequency = how many wavelengths pass a given point in 1 second. One Hertz (Hz) is one wave/oscillation per second. A higher frequency means a shorter wavelength and a lower frequency means a longer wavelength. For example, handbell A4 is tuned to 440Hz. Meaning with all things created equal, 440 wavelengths pass by the listener's ear per second.

Lesson 4: Changing the perceived frequency – doppler effect

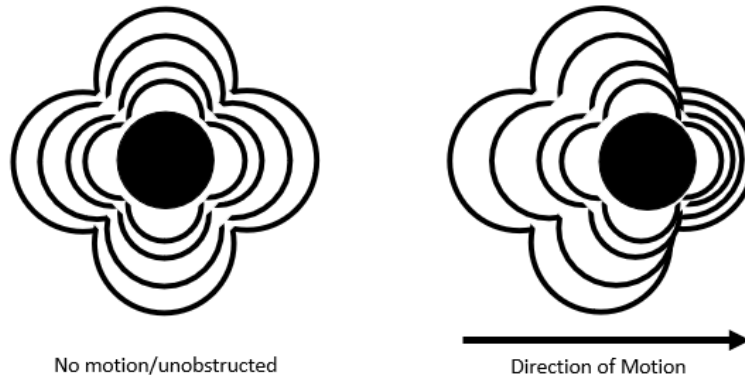


Diagram B: Arial perspective of bell sound

Lab Time: First and foremost – handbell safety is critical!

Applying knowledge of handbell science discussed in class, demonstrate an undocumented handbell technique or an improvement to a handbell technique. Extra points for creativity. **Rule: No bell shall be endangered at any time.**

Optional Lessons:

Lesson 5: Reflected – sound wave bouncing off a surface.

Reverberation versus Echo

Lesson 6: Diffraction – Waves bending around obstacles

Lesson 7: Refracted – Change in medium the wave travels through

Reference Materials:

<http://youtube.com/watch?v=JyP99r5xnuU> (high speed handbell) - carolinahockey00

<https://www.moz.ac.at/sem/lehre/lib/pd-sounddesign/acoustics.html> - Paul Kingsbury

<https://byjus.com/physics/sound> BYJUS education

https://www.thebelltower.com.au/wp-content/uploads/2016/06/Science_of_Bells.pdf - The Science of Bells – The Bell Tower

<https://www.controlnoise.com/support-tools/about-sound-waves/> - Netwell Noise Control

Thank you to **Monica S. McGowan, Ringing Restorations LLC** for the use of the demo castings.