

The Fourth Wall:

How Music Works: The Science of Sound Educational Guide, Grades K-8



About the Performance

Using a live oscilloscope, images of wave forms, interactive activities, and (of course) our hybrid arts aesthetic, students learn how vibration, waves, frequency, and amplitude combine with melody, accompaniment and harmony to create music. This interactive, STEAM (Science, Technology, Engineering, Arts, and Math) performance was created to specifically address 3rd grade national education standards, but is appropriate and has been performed for students in grades K-8.



About the Artist

Few musical ensembles earn top marks for their "deft choreography," but this is no ordinary ensemble. Part chamber music group, part devised theatre company, part modern dance troupe, part circus act, The Fourth Wall blends music, theatre, dance, and acrobatics into a new hybrid art form.

Program Learning Goals

1. To understand how all sounds create waves in the air, and how these waves can vary in shape and size, resulting in musical changes to timbre, pitch, and dynamics.
2. To learn how the interactions between sound waves create differences between melody and accompaniment as well as harmonies that sound unison, consonant, or dissonant depending on the ratios of the frequencies.

Essential Questions

1. In what ways are music and science similar?
2. How do you enjoy music?
3. What do you watch or pay attention to during a performance? What makes a live performance interesting for you?

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Vocabulary

- **Waves:** vibrating energy that look like waves. Sound waves travel back and forth through solids, liquids and gases to get to another location.
- **Timbre:** The quality of sound.
- **Frequency:** How many waves there are per second.
- **Pitch:** Describes how low or high a note sounds.
- **Harmony:** The sound of two or more notes heard simultaneously.
- **Amplitude:** The height of the wave; how much energy a wave has.
- **Dynamics:** The variation in loudness between notes or phrases.

Key Facts and Cultural Context for Students

What is Hybrid Arts?

Many cultures all over the world combine music, dance, acting, and acrobatics, but Fourth Wall's particular style of performance is something they are constantly reinventing. They call it hybrid arts, but you can see versions of the idea in variety shows from early 20th century America called Vaudeville where lots of different performers would appear throughout a show, each doing something unique from music to dance, clowning to comedy. Their main instruments are flute (Hilary), bass trombone (Neil), and vibraphone (Greg), but you'll see several others in their shows. Because our hybrid arts style combines lots of art forms at the same time, watch for how the music we play connects to the motions we make as dancers and how those motions allow us to interact with each other theatrically.



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Pre-Show Activity: How Do Instruments Make Sound?

We can divide all the instruments in the world into five categories based on how they make sound:

- Aerophones where sound is produced by vibrating air
- Chordophones which use one or more strings stretched between fixed points to make sound
- Membranophones which use a tightly stretched membrane to make sound
- Idiophones where the sound is produced by the body of the instrument vibrating
- Electrophones which make sound by electric action or amplification

We've compiled this playlist (https://www.youtube.com/playlist?list=PLOTdSLXcxRWVVpp_jCNmCdhzg8fEJLEII) of instruments from all over the world as an example of these different ways sound can be made.

Watch each video and try to classify the instrument as an Aerophone, Chordophone, Membranophone, Idiophone, or Electrophone.

Definitions drawn from:

<https://www.goshen.edu/academics/music/mary-k-oyer-african-music-archive/instrument-classification/>

Post Performance Discussion Questions:

1. How does the science of sound help us understand the way music works as an art form?
2. How does hearing and seeing music combined with movement make the math and physics of sound waves clearer?

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Post-Show Activity: Design an Instrument

Design an instrument that takes 3 people to play - based on its design, what does it sound like?

In The Fourth Wall, we work together to create a performance combining music and choreography. Sometimes we even help play each other's instruments! Use your imagination to draw an instrument that requires three people to play. Think about how it creates vibrations and what each person's job might be making the instrument work:

Is the instrument so large that it needs three people to hold it and reach different buttons or strings?

Maybe it's a small instrument that has lots of different parts which have to be moved at the same time to create music.

Does your instrument make just one sound, or is it more like a whole band?
Based on your design, is this instrument an Aerophone, Chordophone, Membranophone, Idiophone, Electrophone, or a combination of these categories?

What do you think it will sound like?

What is the first piece of music you will play on it?

For an added challenge, you can try building a prototype of your instrument using found and recycled objects.

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Further Resources

International instrument classification playlist - what makes that sound, how does it vibrate?

Aerophone, ideophone, membranophone, chordophone:

https://www.youtube.com/playlist?list=PLOTdSLXcxRWVVpp_jCNmCdhzg8fEJLEII

Instrument building ideas: <https://www.bashthetrash.com/instruments>

More about Vaudeville:

<https://kids.britannica.com/students/article/vaudeville/339391>

Curricular Connections

Music K-8

Creating

1. Generate and conceptualize artistic ideas and work. Improve short original musical ideas. (M.Cr.01)
2. Organize and develop artistic ideas and work. Connect multiple original musical ideas together into a single piece. (M.Cr.02)
3. Refine and complete artistic work. Explore different musical ideas by experimenting with the voice or instruments. (.M.Cr.03)

Responding

7. Perceive and analyze artistic work. (M.R.07)
8. Interpret intent and meaning in artistic work. (M.R.8)
9. Apply criteria to evaluate artistic work. Demonstrate active listening as an audience member (.M.R.09)

Connecting

10. Synthesize and relate knowledge and personal experiences to make art. (M.Co.10)

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Physical Science PreK-3 :

PS4. Waves and Their Applications in Technologies for Information Transfer: PreK-PS4-1(MA) Investigate sounds made by different objects and materials and discuss explanations about what is causing the sounds. Through play and investigations, identify ways to manipulate different objects and materials that make sound to change volume and pitch.

1-PS4-1. Demonstrate that vibrating materials can make sound and that sound can make materials vibrate.