

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) The Fourth Wall's 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 Artists

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. The Fourth Wall is comprised of flutist **Hilary Abigana**, bass trombonist **C. Neil Parsons**, and percussionist **Greg Jukes**.

Program Learning Goals

1. To understand how all sounds create waves in the air.
2. To explore how sound waves can vary in shape and size, resulting in musical changes to timbre, pitch, and dynamics.
3. 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 travels back and forth through solids, liquids and gases to get to another location; the travel pattern looks like ocean waves
- **Frequency:** how many waves exist per second
- **Amplitude:** the height of a wave, how much energy in a wave
- **Pitch:** how low or high a note sounds
- **Melody:** a series of notes that creates the main part of a song or piece of music
- **Harmony:** individual notes or groupings of notes that accompany and support the melody
- **Timbre:** the quality of sound
- **Dynamics:** how loud or soft a note sounds, musical volume

Key Facts and 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.

Think About It!

As you watch the performance, notice the way Hilary, Neil, and Greg connect the music they are playing to the movements they are making as dancers. How do their movements change with the rhythm (pattern of sound), tempo (speed), or dynamics (volume) of each piece of music? How do they interact with each other?



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Pre-Performance Discussion Questions

- What instruments do you know? How are they played? How do they make sound?
- What is your favorite way to listen to music?
- When was the last time you heard someone playing music or singing in-person? Was it interesting to watch? What did you notice or pay attention to during the performance?

Pre-Performance Activity: How Do Instruments Make Sound?

Learning Goals:

- To explore musical instrument classifications based on how they produce sound
- To identify and sort musical instruments by their classification categories

Materials:

“World Instrument Categories” YouTube playlist:

https://www.youtube.com/playlist?list=PLOTdSLXcxRWVpp_jCNmCdhzg8fEJLEII

Directions:

1. Discuss musical instruments and their instrument families (strings, woodwinds, brass, percussion). Ask students if they play any instruments and to identify their instrument families.
2. Introduce the Hornbostel-Sachs instrument classification system, which divides all the instruments in the world into five categories based on how they make sound:
 - **Aerophones:** sound is produced by vibrating air
 - **Chordophones:** use one or more strings stretched between fixed points to make sound
 - **Membranophones:** use a tightly stretched membrane to make sound
 - **Idiophones:** sound is produced by the body of the instrument vibrating
 - **Electrophones:** make sound by electric action or amplification
 - For more information on categorization, visit:
<https://www.goshen.edu/academics/music/mary-k-oyer-african-music-archive/instrument-classification/>
3. Watch the “World Instrument Categories” playlist on YouTube. This playlist was curated by The Fourth Wall to feature different instruments from all over the world. While watching, classify each instrument as an Aerophone, Chordophone, Membranophone, Idiophone, or Electrophone.
4. Discuss the similarities and differences between the featured instruments on the playlist.

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Post-Performance Discussion Questions

- What was your favorite part of the performance? What did it teach you?
- How does the science of sound help us understand the way music works as an art form?
- How does hearing and seeing music combined with movement make the math and physics of sound waves clearer?

Post-Performance Activity: Design an Instrument

Learning Goals:

- To identify and explore how musical instruments vibrate air to produce sound
- To create an original musical instrument design that is operated by three people

Materials:

“Design an Instrument” Worksheet (see page 5)

Directions:

1. Discuss The Fourth Wall’s performance. Note how they worked together combining music and choreography, and sometimes even helped play each other’s instruments!
2. Review how instruments vibrate air to produce sound. Revisit the “How Do Instruments Make Sound?” activity, if needed (see page 3).
3. Ask students to use their imagination to create an instrument that requires three people to play. Complete the “Design an Instrument” worksheet and draw a picture of the instrument on the back.
4. Share the instrument designs with the class. Discuss how the instrument makes sounds and how three people would work together to play it. How are the original instruments similar or different to familiar instruments in a band or an orchestra? What types of music would the original instruments play?

Extensions:

- After presenting the instrument designs, discuss whether each instrument is an Aerophone, Chordophone, Membranophone, Idiophone, Electrophone, or a combination of these categories (see page 3 for definitions).
- Have students build a prototype of their instrument using found and recycled objects.



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Name: _____

Design an Instrument!

Directions: Use your imagination to create an instrument that requires three people to play. Answer the questions below to brainstorm your design, then draw your creation on the back of this worksheet.



What size is your instrument? _____

Do the players hold it or set it on the ground? _____

Do the players work together to make one sound or three different sounds?

Circle up to 3 ways your instrument will make sound:

Pluck a string

Blow into a tube

Flip a switch

Strike with a mallet

Tap with a hand

Buzz lips into a mouthpiece

Push a button

Bow a string

Other: _____

What job will each person have to play the instrument?

- Person 1: _____
- Person 2: _____
- Person 3: _____

What do you think your instrument will sound like?

What is the first piece of music that you will play on your instrument?

Now draw your musical instrument creation on the back!

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Further Resources

- [The Fourth Wall Artist Website](#)
- [Bash The Trash: How to Build Musical Instruments](#)
- [“Vaudeville” article by Britannica Kids](#)
- Hood, Susan: *Ada’s Violin: The Story of the Recycled Orchestra of Paraguay*, Simon & Schuster Books For Young Readers (2016)
- Marsalis, Wynton: *Squeak, Rumble, Whomp! Whomp! Whomp!:* A Sonic Adventure, Candlewick Press (2021)
- Morland, Charlie: *Music and How it Works: The Complete Guide for Kids*, DK Children (2020)
- Oliver, Carmen: *Building an Orchestra of Hope: How Favio Chavez Taught Children to Make Music from Trash*, Eerdmans Books for Young Readers (2022)
- Woo, Eddie: *It’s a Numberful World: How Math Is Hiding Everywhere - from the Crown of a Tree to the Sound of a Sine Wave*, The Experiment; Illustrated edition (2019)



Curricular Connections

Arts Standards: Dance, Music, and Theatre

Creating

- Generate and conceptualize artistic ideas and work. (D.Cr.01, M.Cr.01, T.Cr.01)
- Organize and develop artistic ideas and work. (D.Cr.02, M.Cr.02, T.Cr.02)

Performing

- Convey meaning through the presentation of artistic work. (D.P.06, M.P.06, T.P.06)

Responding

- Perceive and analyze artistic work. (D.R.07, M.R.07, T.R.07)
- Interpret intent and meaning in artistic work. (D.R.08, M.R.08, T.R.08)
- Apply criteria to evaluate artistic work. (D.R.09, M.R.09, T.R.09)

Connecting

- Synthesize and relate knowledge and personal experiences to make art. (D.Co.10, M.Co.10, T.Co.10)
- Relate artistic ideas and works to societal, cultural and historical contexts to deepen understanding. (D.Co.11, M.Co.11, T.Co.11)

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Curricular Connections, continued

English Language Arts and Literacy Anchor Standards

Speaking and Listening

- Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. (SL.PK-12.2)
- Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric. (SL.PK-12.3)

Science and Technology/Engineering

Physical Science

- Motion and Stability: Forces and Interactions (K.PS.2, 3.PS.2, 8.PS.2)
- Waves and Their Applications in Technologies for Information Transfer (1.PS.4, 4.PS.4, 6.PS.4)
- Matter and Its Interactions (2.PS.1, 5.PS.1)
- Energy (4.PS.3, 7.PS.3)

Technology/Engineering

- Engineering Design (1.ETS.1, 2.ETS.1, 3.ETS.1, 4.ETS.1, 5.ETS.3, 6.ETS.1, 7.ETS.1)
- Materials, Tools, and Manufacturing (6.ETS.2, 8.ETS.2)
- Technological Systems (7.ETS.3)

