



Turn it Up!

Make a cell phone amplifier by mixing clay with a little bit of science

(art + science)

Have you ever wondered why people cup their hands around their mouth when calling for someone? Using hands in this way amplifies a voice by directing more sound toward the target and also by drawing more volume from one's mouth. Cupping the hands creates a kind of cone shape, much like a megaphone, the "speaker" on an old Victrola record player, or a Victorian hearing aid, called an ear trumpet.

Ear trumpets, first manufactured around 1810, collect sound waves and lead them into the ear, serving as hearing aids. Ludwig Van Beethoven used one!

Another distinct cone-shaped device called the Pinard horn was a type of stethoscope which was used by midwives to monitor the heart tones of an unborn baby. Pinard horns are made of an 8" long wooden cone and were invented in France in the 19th century. They are still used in many parts of France today.

The cone shape works to amplify sound in two ways. First, the cone directs sound. As sound emerges from any source, it travels outward in all directions, going left, right, up, and down, as well as straight ahead. Using a megaphone is a lot like using a funnel in that it directs more sound toward your target, and allows less to scatter to the sides.

But that is only half of the story! A cone can actually draw more volume in the first place. This is because whenever a sound wave moves from a narrow space to a more open one, some of the sound is reflected backward. This is exactly what happens when a person shouts — the sound made by the voice moves from the narrow confines of the mouth into the wide, open air. The sudden change bounces some of the sound energy backward, where it's absorbed by the mouth, reducing the overall volume. The cone shape helps to create a more gradual

Materials (required)

Amaco #38 White Stoneware Clay, 50 lb (30503-1038); need 2 lbs for each student

Pro Needle Tool (34920-1063); share six across class

Amaco Celebration Lead-Free High Fire Glazes (30458-); share multiples colors across class

Yasutomo Hake Brush, Adjustable, 5-1/2" (05425-4055); break apart, and share two across class

Materials (optional)

Large Wooden Paddle Tool Set (30386-1009)

Amaco Decorative Sprig Molds, Foot mold (30705-1010)

8-Piece Beginner Pottery Tool Set (33091-1008)



transition from mouth to open air, which reduces the amount of sound that bounces backward, allowing more volume to be released. To work best, a megaphone should be at least as long as the wavelength of the sound it's amplifying. Human voices have wavelengths up to several feet long, so a professional megaphone, like a cheerleader might use, is also several feet long.

Making a simple amplifier for a cell phone is as easy as constructing a cone shape for the phone to sit in. Build a cone, cut a slot toward the back to accommodate a cell phone, fire, and turn up the volume!

GRADES 3-12 Note: Instructions and materials are based upon a class size of 24 students. Adjust as needed.

Preparation

1. Cover tables and provide each student with approximately 2 lbs of clay.
2. Discuss the way a cone shape amplifies sound waves.

Process

1. Choose a method for forming a cell phone amplifier. Cone shapes can be made easily by coiling, slab building, or even throwing on a potter's wheel. The smallest end of the cone must be large enough to allow the cell phone to fit toward the back. A starting measurement of about 4-5" in diameter at the back of the cone works well.
2. Now, create a cone that opens up gradually from 4" and gets wider as it gets longer. The length of the cone could be determined by the amount of space available for the amplifier. A longer cone will result in a higher volume of sound. When the cone is leather hard, cut a slot with a needle tool about an inch from the back of the cone that is about 1/2" deeper and wider than the body of the cell phone to be amplified. Smooth all edges well.
3. To enable the cone to sit on a surface, one side of the cone can be flattened, or legs can be added to aid with stability. Tap the leather hard cone onto the surface of the table to flatten one side, or use a flat wooden paddle. If adding legs, be sure to score and slip both the legs and the attaching point on the cone. Embellish the cell phone amplifier by turning it into an animal if desired. Added eyes, teeth, or ears will make a more whimsical speaker.
4. After bisque firing to cone 04, apply glaze using a natural bristle brush in three flowing coats. Amaco Celebration Glazes feature very bright, opaque coverage. Fire to cone 5. The added vitrification of the clay and glaze will allow even more sound volume.

Options

Build a horizontal tube with cones at each end for stereo sound.



Step 1: Make a cone shape for the body of the amplifier. Cut a slot about 1/2" larger than the width and depth of the cell phone to be amplified at the back of the cone. Smooth edges.



Step 2: Add feet or facial features if desired by slipping and scoring.



Step 3: After bisque-firing, brush on bright, opaque glazes in three coats. Insert phone and turn it up!

National Core Arts Standards - Visual Arts

Creating

Anchor Standard 1: Generate and conceptualize artistic ideas and work.

Connecting

Anchor Standard 11: Relate artistic ideas and works with societal, cultural, and historical context to deepen understanding.